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THE ETIOLOGY OF BERIBERI

By RICHARD P. STRONG and B. C. CROWELL

(From the Biological Laboratory, Bureau of Science, Manila, P. I.)



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THE ETIOLOGY OF BERIBERI.

By RICHARD P. STRONG and B. C. CROWELL.

(*From the Biological Laboratory, Bureau of Science, Manila, P. I.*)

The etiology of beriberi is a problem about which there has been very extensive and prolonged controversy. The theories advanced in regard to the cause of the disease have been numerous and of widely different characters. Many of them have been based upon little or no accurate experimental investigation. Notwithstanding the large number of very valuable observations that have appeared in the literature on this subject during the past few years, at the present time there is no theory of the cause of beriberi that has been entirely accepted. The reason for this becomes more apparent when we consider the recent publications upon the subject. While very extensive feeding experiments by numerous investigators have been performed upon fowls, regarding the production of polyneuritis gallinarum (Eijkman), and while a few similar experiments have been employed, even sometimes successfully, by several investigators in relation to the production of a "beriberi-like" disease in other animals, nevertheless, there has been, regarding the etiology of beriberi, not a single experiment upon man which, from a scientific standpoint, we can regard in any way as a crucial test, with the exception of that one performed by Fraser and Stanton¹ in

¹ Studies from Institute for Medical Research. Federated Malay States (1909), No. 10; *Lancet* (1909), 1, 451.

1909. At the close of their publication regarding this experiment, these authors state:

The general results [of these experiments] lend support to the view that the disease beriberi as it occurs in this Peninsula has, if not its origin in, at least, an intimate relationship with the consumption of white rice and justify further research along these lines.

We have referred to the fact that the theories regarding the etiology of beriberi have been numerous. However, it is not our intention to consider them in detail in this publication. They have been discussed in numerous text-books and, among other authors, particularly by Herzog of this laboratory in 1906,² and more recently by Castellani³ and by Schaumann.⁴ However, we wish to consider briefly the question of whether beriberi is an infectious disease, owing its origin to some living specific microorganism, either bacterial or protozoal, or its toxin, and conveyed directly or indirectly from man to man, or whether it is one due to disturbances in metabolism caused by an abnormal diet. Among those who have had a wide experience with beriberi and who have favored the theory that the disease is an infectious one and not one due to deficient or scanty nutrition may be mentioned Manson,⁵ Scheube,⁶ Balz,⁷ Jeanselme,⁸ le Dantec,⁹ Marchoux,¹⁰ Daniels,¹¹ Wright,¹² Castellani,¹³ and Shibayama,¹⁴ and the arguments which some of these writers deduce against the theory of a dietetic causation are very convincing. Castellani,¹⁵ writing in 1910 after a consideration of Fraser and Stanton's experiments, states:

² *This Journal* (1906), 1, 709.

³ Castellani and Chalmers, *Manual of Tropical Medicine*. London (1910), 888.

⁴ *Beiheft z. Arch. f. Schiffs- u. Trop.-Hyg.* (1910), 14, 329.

⁵ *Tropical Diseases*. London (1907), 367; *Allbutt's System of Medicine* (1907), 2, Pt. II, 619.

⁶ *Die Krankheiten der warmen Länder*. Jena (1903), 265.

⁷ *Mense's Handbuch der Tropenkrankheiten* (1905), 146.

⁸ *Le bérubéri*. Paris (1907), 1; *Bull. Soc. path. exotique* (1910), 3, 8.

⁹ *Ibid.*, *Bull. Soc. path. exotique* (1910), 63, 118, 122.

¹⁰ *Ibid.*, 116.

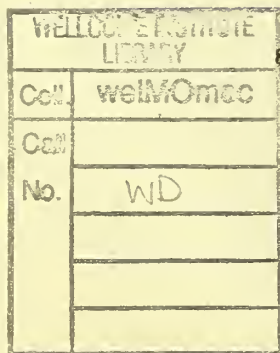
¹¹ *Studies from Institute for Medical Research*. Federated Malay States (1906), 4, No. 8, Pt. I, 91.

¹² *Ibid.* (1902), 2, No. 2, 58.

¹³ *Loc. cit.*

¹⁴ *This Journal*, *Sec. B* (1910), 5, 123.

¹⁵ Castellani and Chalmers, *Manual of Tropical Medicine*. London (1910), 884.



To summarize from the evidence, it appears more likely that a parasite will be found to be the spreader of the disease, which makes it more probable that the actual cause will be found to be a protozoon than that it is due to diet, which, however, may be a predisposing cause, especially if the nutritive value of the food is low, or the proportions wrong.

Shibayama ¹⁶ also holds a somewhat similar view:

It is therefore not unreasonable to assume that the microorganisms of beriberi are only present in the Orient and, given a predisposing cause, are capable of causing the disease, whereas in the West beriberi does not appear, owing to the absence of the infecting organisms, although the same favorable predisposing cause may be present.

Marchoux ¹⁷ (also writing in 1910) believes that a diet of white rice furnishes in the intestine a favorable culture-medium for the development of the specific organism of beriberi and that the addition of rice-bran to the diet without doubt renders the condition in the intestine unfavorable for the development of this organism.

However, none of these authors has brought forward any definite proof that beriberi is caused by a specific microorganism and, although numerous other investigators have described either various species of bacteria or of protozoa as the cause of the disease, yet to-day not one of these claims has been substantiated from a scientific standpoint. Obviously, however, the fact that the specific microorganism for the disease has not been discovered is not a final argument against its infectious nature, for the causative organism in many diseases of an undoubted infectious nature has been sought for as diligently and in a manner equally as unsuccessful as in the case of beriberi. The result of the experiments of de Haan and Grijns ¹⁸ failing to demonstrate the presence of antibodies in the blood serum or various organisms of beriberi patients or of fowls suffering with polyneuritis, as well as that of the experiments of Shiga and Kusama, ¹⁹ who failed to obtain the reaction of deflection of the complement in the serum of beriberi cases, also does not exclude definitely the possibility of the disease being an infectious one.

However, if by scientifically controlled and accurate experiments we can produce the disease and exclude the influence of a living specific microorganism, the infectious theory of its origin

¹⁶ *Loc. cit.*

¹⁷ *Loc. cit.*

¹⁸ *Genees. Tyds. v. Ned. Ind.* (1909), 49.

¹⁹ *Beihefte z. Arch. f. Schiff's- u. Trop.-Hyg.* (1911), 15, 61.

can be regarded as tenable no longer. Recently, few investigators²⁰ have pursued researches relating to a search for a specific organism for beriberi, but, on the other hand, the theory that the disease owes its origin to disturbances in nutrition has been widely discussed. However, as mentioned, the great majority of these recent publications relate to experiments upon the production of polyneuritis gallinarum and not to the production of beriberi in man.

In regard to the relation of polyneuritis gallinarum to beriberi, it seems advisable to consider the views of a number of investigators upon this subject. Shibayama²¹ cautions against regarding polyneuritis of fowls as being identical with human beriberi, and Eijkman²² states:

Regarding the question of the relationship between polyneuritis gallinarum and beriberi, I have always expressed myself very reservedly. I have not claimed their identity in an etiological sense, but I also could not absolutely deny this, and am of the same opinion at the present time. In my first publication (1889) I have mentioned besides the many points of agreement in the two, also some points of difference.

Schaumann²³ believes:

Not that both diseases are identical but that there seem to exist many more reasons for assuming that both are intimately related to each other than to presume the contrary, chiefly by taking into consideration that the same cause must not necessarily have the same results in different organisms.

Shiga and Kusama²⁴ state:

It would be too much to say that the polyneuritis of animals and beriberi are identical without further proof. Many prominent authorities, both clinicians and pathologists, are of the opinion that in the diagnosis of human beriberi two chief symptoms, namely the sensory and motor paralyzes of the lower legs and the dilatation and hypertrophy of the heart, must be considered.²⁵

Fraser, in December, 1911,²⁶ states:

On account of the prominence given the experiments on animals, it is possible to lose sight of the fact that we, as medical men, are concerned with the etiology of a disease which affects men, and is known as beriberi.

* * * Experiments on fowls have proved to be of an inestimable value

²⁰ See Bréaudat, *Bull. Soc. path. exotique* (1910), 3, 13, 65, 123, 128, 317; le Dantec, *ibid.*, 62, 118, 122; Mathis and Leger, *ibid.*, 352; and Kohlbrügge, K. Akademie van Wetenschappen te Amsterdam (1911), 904.

²¹ *Loc. cit.*

²² *Arch. f. Schiffs- u. Trop.-Hyg.* (1911), 15, 702.

²³ *Trans. Soc. Trop. Med. & Hyg.* (1911), 5, 89.

²⁴ *Beihefte z. Arch. f. Schiffs- u. Trop.-Hyg.* (1911), 15, 65.

²⁵ As Shiga only found dilatation of the heart in one monkey, his subsequent conclusions seem hardly justified.

²⁶ *Trans. Soc. Trop. Med. & Hyg.* (1911), 5, 81.

in working out the etiology of beriberi; the reaction in fowls is quite as delicate as, and comparable with, a reaction *in vitro*, but there is no necessity whatsoever to argue for or against the identity of polyneuritis in fowls and beriberi in man.

On the other hand, Chamberlain and Vedder²⁷ and Tsuzuki²⁸ believe that polyneuritis gallinarum and beriberi are essentially the same disease. Obviously, however, this latter view seems hardly justifiable until confirmed by further experiments on human beings.

We believe that, while experiments on fowls have been of very great benefit in elucidating many problems relating to the etiology and cure of beriberi, nevertheless, without similar experiments or observations on man, the results obtained with the former would not be applicable to man. The experiments on fowls have certainly in some instances furnished a justification for adopting a similar method of procedure in man in relation to the study and care of beriberi, and therein perhaps lies their greatest value. The results of the experiments on other animals, including monkeys (Eijkman,²⁹ Fraser and Stanton,³⁰ Schau-mann,³¹ Aron,³² Shiga and Kusama,³³ Wright,³⁴ Durham,³⁵ and others), have been hitherto too uncertain to warrant our drawing conclusions from them in relation to beriberi in man. Monkeys as well as fowls sometimes suffer with polyneuritis from various causes.

Since, before we can arrive at a definite decision as to the infectious or noninfectious nature of the disease beriberi, we must have observations upon man in relation to this question, let us consider the previous literature upon the subject with the idea of ascertaining what experimental evidence there previously has been presented in which a reasonable supposition for a cause of the disease exists and in which the action of a specific organism conveyed directly or indirectly from man to man as the etiological factor has been rigidly excluded.

²⁷ *This Journal, Sec. B* (1911), 6, 395.

²⁸ *Bull. Soc. path. exotique* (1911), 4, 588.

²⁹ *Virchow's Arch.* (1897), 148, 523.

³⁰ Studies from Institute for Medical Research. Federated Malay States (1911), No. 12, 28.

³¹ *Beihefte z. Arch. f. Schiffs- u. Trop.-Hyg.* (1910), 14, 544.

³² *This Journal, Sec. B* (1910), 5, 95.

³³ *Beihefte z. Arch. f. Schiffs- u. Trop.-Hyg.* (1911), 15, 67.

³⁴ Studies from Institute for Medical Research. Federated Malay States (1902), 2, No. 2, 63.

³⁵ *Journ. Hyg.* (1904), 4, 129.

VIEWS OF SOME PREVIOUS INVESTIGATORS.³⁶

The idea that beriberi is a disease which may have a dietetic causation is a very old one. Van Leent, as early as 1867,³⁷ writes:

The principal cause of beriberi is recognized as being a diet too uniform, insufficient, and of bad quality. The body, deprived of indispensable elements for the maintenance of the normal composition of the blood and consequently of its nutrition, becomes impoverished little by little.

Later, in 1880,³⁸ van Leent regards the cause of beriberi as due to too small a proportion of albuminous substances or of fat in the diet.

The Anglo-Indian physicians at an early period pointed to an insufficient diet or a diet not corresponding to the needs of the body, such as the exclusive or preponderant use of rice and of dried fish as a cause of the malady, and many observers in the Dutch East Indies and Japan assigned such a cause the first place in the etiology.³⁹

A similar view was held by Maget and Wernich⁴⁰ who studied the disease in Japan. The latter wrote:

Rice, as the exclusive food of the people, is answerable for beriberi in a quite special way. Not, however, as some have thought, because it is used in a decomposed state, but because it is used in such quantities that the power of assimilation is gradually lost for other kinds of food; and even the large quantity of rice is unable to render the nutrition and blood-making adequate; although the Japanese diet contains albuminous elements in the form of fish and bean-cheese, these are not sufficient.

Takaki⁴¹ believed that beriberi is caused by the disproportion of nitrogenous and nonnitrogenous elements (nitrogen and carbon in food); that is, the amount of the nitrogenous was insufficient and that of the nonnitrogenous excessive. Up to 1883 the cases in the navy in Japan averaged over one-fourth of its strength and in that year there were 1,236 cases of beriberi among 5,349 men. In 1884 the diet was changed, a larger proportion of nitrogenous food being given, and in 1885 there were

³⁶ In this consideration of the previous investigations of other authors only those relating to the occurrence of beriberi in the Tropics have been reviewed and not those, with one exception, relating to ship beriberi.

³⁷ *Arch. d. Med. Nav.* (1867), 241.

³⁸ *Genees. Tijd. v. Ned. Ind.* (1880), 9, 295.

³⁹ Hirsch's *Handbuch der historisch-geographischen Pathologie* (1883), 2, 414.

⁴⁰ *Geographisch-medizinische Studien.* Berlin (1878), 193.

⁴¹ *Lancet* (1906), 1, 1371, 1451, 1520.

only 41 cases, in 1886 only 3. By the beginning of 1891, under the improved diet, beriberi was entirely eradicated and the incidence of other diseases greatly decreased. Other hygienic measures were also introduced into the navy during these years.

Vorderman,⁴² in a study based on Eijkman's researches observed that fully hulled and incompletely hulled rice as a food influenced the occurrence of beriberi among the prisoners in the Dutch East Indies in quite a different way. He states that of 96,530 prisoners who were fed chiefly with incompletely hulled rice (that is, in which not more than 25 per cent of the pericarp was removed from the grain) only 9, that is 0.009 per cent, sickened with beriberi, while of 150,226 prisoners fed chiefly with fully hulled rice (that is, in which only 25 per cent of the pericarp remained with the grain) 420, that is 2.079 per cent, suffered from beriberi. The conclusion reached was that a connection existed between the prevalence of beriberi and the consumption of hulled rice.

In the year 1901 Røelfsema⁴³ observed an epidemic of beriberi among the coolies at the coaling station at Sabang, Sumatra. He could not observe any amelioration in the condition of the patients when he gave them meat and other extra articles of food, but he did observe that the epidemic ended as soon as he prescribed *katjang idjo*.

Hulshoff-Pol⁴⁴ repeated these experiments in the Insane Asylum at Buitenzorg. During the period from August 1 to April 30, 1902, the patients from 12 pavilions in the asylum received the following in addition to the ordinary diet: In 3 pavilions, 150 grams of *katjang idjo*; in 3 pavilions, 300 grams of fresh greens; and in 6 pavilions, ordinary diet. The pavilions were disinfected once a week with carbolic soap, 3 per cent, in order to kill any insects which might be of importance in the dissemination of beriberi. The following results were obtained: Among 70 insane who ate *katjang idjo*, none developed beriberi; among the 86 who were given fresh greens, 16 cases; and among the 78 who lived in the disinfected pavilions, 33 contracted the disease. There were 58 control patients of whom 19 contracted beriberi.

Kiewiet de Jonge⁴⁵ repeated Hulshoff-Pol's experiments on 384 patients in the Insane Asylum at Buitenzorg. *Katjang idjo* was given to 182 of these, but not to the remaining 202. The results were as follows:

⁴² Cited by Schaumann, *Beihefte z. Arch. f. Schiffs- u. Trop.-Hyg.* (1910), 14, 344. See also, Eijkman, *Arch. f. Schiffs- u. Trop.-Hyg.* (1911), 15, 699.

⁴³ Quoted by de Haan, *This Journal*, Sec. B (1910), 5, 69.

⁴⁴ Cited by de Haan, *loc. cit.*

⁴⁵ *Genees. Tyds. v. Ned. Ind.* (1909), 49.

As to the curative action of katjang idjo.

	With <i>katjang idjo</i> (per cent).	Without <i>katjang idjo</i> (per cent).
Suffered from beriberi and remained unchanged	15.0	23.4
Improved	75.0	13.3
Became worse	10.0	63.3
Died	2.5	30.0

Braddon,⁴⁶ from his observations from 1901 to 1906 relating to beriberi, became fully convinced:

That the disease was not in any sense an infection but a form of food poisoning of which the cause lay in the nature of the grain. That in places and in communities where rice-eaters and non-rice-eaters lived side by side, sharing in common the chances of supposable infection, beri-beri attacked invariably only rice-eaters, never the non-rice-eaters. That among rice-eaters, otherwise equally exposed to infection, beri-beri again attacked those only who ate certain sorts of rice, or rather rice in a certain condition. Those who ate fresh rice (as prepared by the Malay *i. e.*, hand pounded daily for their own use) and those who ate rice prepared by the parboiling process (as customarily used by Tamils, cured rice) never got beri-beri. It attacked those only whose staple diet was the common commercial white rice of the shops, the so-called Rangoon or Siam rice—sorts which, in contradistinction to the other varieties, were designated “non cured.” That the severity of the disease and its extent (the number of attacked) in communities was directly proportional to the quantities of the rice consumed. Its progress, whether as a malady of the individual, or as an epidemic in communities becoming greater when the rice was increased, diminished when this was lessened, and ceasing altogether when the noxious rice was withdrawn, without change of any other circumstance.

He believed that the rice husk contained a special fungus which is able after decortication to affect the seed saprophytically and to produce a poison therein. He collected very extensive statistical evidence regarding his claims and insisted upon his arguments with great energy. Although Braddon’s ideas were vigorously opposed by many authorities on beriberi, some of whom, after examining his evidences, claimed that the hypothesis that diet can cause the disease has no facts to support it, nevertheless, he maintained the courage of his convictions and eventually the government was persuaded to investigate the question. Official permission was granted to conduct an inquiry, and Doctor Braddon having found a place where the conditions were considered favorable, a research was planned and carried out with Doctor Fraser.⁴⁷ The result of this study has been

“The Etiology of Beri-beri. Federated Malay States Medical Archives (1901); Cure and Prevention of Beri-beri. London (1907); The Discovery of the Cause of Beri-beri. London (1911).

⁴⁷ *Trans. Soc. Trop. Med. & Hyg.* (1911), 5, 81.

reported by Fraser and Stanton,⁴⁸ and will be considered later in this paper.

Fletcher in 1907⁴⁹ states:

During the year 1905 an epidemic of beri-beri broke out in the Kuala Lumpur Lunatic Asylum. Commencing in February, it reached its height in July and August, declining somewhat towards the end of December. Out of 219 lunatics treated in the asylum during the year 94 persons were affected, of whom 27 succumbed to the disease. The chief constituent of the rations supplied to the inmates of the asylum was uncured (Siamese) rice, and in view of the fact pointed out by Dr. Braddon that beri-beri occurs chiefly amongst communities with whom such rice is the staple article of diet it was decided, with the sanction of the Government, to place half the lunatics on cured (Indian) rice. The Government readily gave its consent and the experiment was commenced on Dec. 5th, 1905. Except for the difference in the rice the two parties—those on cured and those on uncured rice—received the same kind and the same amount of rations. Excepting the rice the food-stuffs for all patients were prepared together in the same kitchen and cooked in the same cooking pots.

The lunatics are housed in two exactly similar buildings on opposite sides of a quadrangle surrounded by a high wall. On Dec. 5th all the lunatics at that time in the hospital were drawn up in the dining shed and numbered off from the left. The odd numbers were subsequently domiciled in the ward on the east side of the courtyard and no alteration was made in their diet, they were still supplied with the same uncured rice (Siamese) as in 1905. The even numbers were quartered in the ward on the west of the quadrangle and received the same rations as the occupants of the other ward, with the exception that they were supplied with cured (Indian) rice instead of the uncured Siamese variety. The following is the ordinary diet scale of the lunatic asylum: fresh meat, 4 ounces four times a week; fresh fish, 5½ ounces two times a week; salt fish, 5½ ounces once a week; vegetables, 8 ounces daily; curry stuffs, 1½ ounces daily; and cocoanut oil, ¾ of an ounce daily. Uncooked rice: Siam, 28 ounces to be supplied as per sample for uncured rice ward; Bengal, 28 ounces to be supplied as per sample for cured rice ward. At the commencement of the experiment all patients showing unmistakable symptoms of beri-beri were removed to the district hospital, which is two miles distant from the asylum. On Dec. 5th there were 59 lunatics in the asylum; of these 29 were put on cured rice and 30 on Siamese rice. The next patient admitted to the asylum was admitted to the Bengal rice ward, and the one admitted after him to the uncured rice ward, the next to the cured, and so on alternately to the end of the year.

The result up to December 31 1906 (i. e., one year and 26 days) was that 34 out of 120 persons fed on uncured rice suffered from beri-beri and 18 died, whilst among 123 patients dieted on cured rice there were no deaths from beri-beri and only two cases, both of whom were suffering from the disease on their admission to the asylum.

⁴⁸ *Lancet* (1909), 1, 451; Studies from Institute for Medical Research. Federated Malay States (1909), No. 10.

⁴⁹ *Lancet* (1907), 1, 1776.

In a subsequent paper,⁵⁰ he records the results during the year 1907 when 136 patients were treated in the "uncured" rice ward. Of these patients 28 suffered from beriberi, 4 of whom were suffering from the disease on their admission, while in 24 the disease developed whilst they were in the asylum. During the same year, 131 patients received a diet containing "cured" rice; 4 of them were admitted actually suffering from beriberi, but none of these 131 patients developed the disease in the asylum. Fletcher concludes that the cause of beriberi is to be sought for in the diet, and the result of his experiments tends to show that white polished rice, although of the best quality, is the cause of beriberi, acting either by some poison which it contains or by a starvation due to some defect in the nutritive value of such rice.

Fales,⁵¹ from a study of an outbreak of an epidemic of beri-beri in Bilibid prison, in Manila, came to the conclusion that the lack of fresh vegetables conduced powerfully to both beri-beri and scurvy.

In November, 1901, there were two cases of the disease, and no deaths, in the gaol. The food was then changed to a ration consisting of 97.17 grammes of proteids, 17.24 grammes of fats, 491.04 grammes of carbohydrates and 26.52 grammes of salts. In this diet there were 85.05 grammes of potatoes and 453.60 grammes of rice. Put into other figures, this diet consisted of: Nitrogen, 172.1 grammes; carbon, 4,166.5 grammes; hydrogen, 61.9 grammes; sulphur, 13.2 grammes; salts, 140.2 grammes—the proportion of nitrogen to carbon being as 1 to 24.2, whereas, calculating the weight of Filipinos at 125 pounds, it was estimated that proteids ought, according to Voigt's diet, to have been at least 94 grammes, fats 45 grammes, and carbohydrates 400 grammes; or, according to Moleshott's diet, nitrogen, 256 grammes; carbon, 3,789 grammes; hydrogen, 143 grammes; sulphur, 23 grammes; salts, 172 grammes—*i. e.*, N : C :: 1 : 0.15.

The epidemic of beri-beri now began: December, 1901, 52 cases and 2 deaths; January, 1902, 169 and 12; February, 1,087 and 16; March, 576 and 15; April, 327 and 15; May, 310 and 19; June, 451 and 17; July, 233 and 33; August, 571 and 24; September, 522 and 31.

On October 20 the diet was again changed, and this time proteids were 101.71 grammes; fats, 19.37 grammes; carbohydrates, 395.73 grammes; salts, 29.13 grammes; including 119.07 grammes of potatoes and 255.15 grammes of rice. Nitrogen was 209.8 grammes; carbon, 3,816.2 grammes; hydrogen, 70.4 grammes; sulphur, 17.2 grammes; and salts, 185.8 grammes—N : C :: 1 : 13.4.

In October there were 579 cases and 34 deaths; November, 476 and 8; December, 89 and 3; half January, 1903, 4 cases and no deaths.

Along with the beri-beri there was an epidemic of scurvy, and Fales was of the opinion that both diseases were led up to by a deficiency of vegetables, the essential principle of which he believed to be potassium carbonate, of which rice contains only 0.01 grain per ounce, while potatoes

⁵⁰ *Journ. Trop. Med.* (1909), 12, 127.

⁵¹ Castellani and Chalmers, *Manual of Tropical Medicine*. London (1910), 890. See also, *Journ. Am. Med. Assoc.* (1907), 48, 778.

contain 1.875 grains. Hence, according to Fales, the disappearance of the disease when a sufficiency of vegetables, especially of potatoes, was given. But he says this deficiency is only a predisposing cause, which enables the micro-organism, whatever it is, which is the true cause of the disease, to flourish and produce the symptoms.

Ellis,⁵² in 1903, was convinced that the consumption of moldy, microbic, or otherwise diseased rice is not a cause of beriberi and that his experiments completely disproved any connection between beriberi and food. Later, in 1909,⁵³ he performed experiments in the Singapore Lunatic Asylum in feeding the inmates cured and uncured rice. He concludes that since only cured rice has been employed in the asylum, there has been no recurrence of the disease for over a year, although formerly there were many outbreaks of it.

Fraser and Stanton,⁵⁴ as has already been mentioned, carried out important experiments with reference to Braddon's ideas regarding the causation of beriberi. On account of the great importance of their investigations, we shall quote freely from their report, as follows:

The investigation hereinafter described was undertaken primarily to determine if, when other factors were excluded or controlled people fed on white rice did develop Beri-Beri and if people under exactly similar conditions but fed on parboiled rice did not develop the disease. It was hoped also that opportunity would be forthcoming for the investigation of other aspects of the question.

At the outset it is necessary to state that the disease under investigation is that form of multiple peripheral neuritis, known as Beri-Beri, which occurs endemically in this peninsula and the neighbouring islands. As much confusion has been caused by assigning this name to classes of cases differing widely in their clinical manifestations it is desirable to make it clear that we seek only for an explanation of this disease as met with here.

For the purpose of the inquiry it was necessary to observe two parties of men under similar conditions as to environment, etc., and whose food supply was definitely known. In view of the suggestion [made by numerous observers] that the disease may be bacterial or protozoal in origin it was desirable that the places chosen should have been hitherto uninhabited or that no case of Beri-Beri should have occurred there for some time previously; further the places should be in an isolated district sufficiently remote from towns or villages to exclude as far as possible the entrance of a supposed infection. Such a situation would also have the advantage, on account of the absence of shops, that the men under observation could not readily obtain food other than that supplied to them. It is obvious that the conditions required for such an investigation could not be secured

⁵² *Brit. Med. Journ.* (1903), 2, 1268.

⁵³ *Ibid.* (1909), 2, 935.

⁵⁴ *Loc. cit.*

in a public institution as in all such in these States Beri-Beri is known to be endemic.

Various places were visited with a view to securing satisfactory conditions, and it was finally decided to carry on observations with regard to some three hundred Javanese indentured labourers employed in the work of road construction in a remote part of the Jelebu district in the State of Negri Sembilan * * * the places in which the labourers were at this time located * * * [the fifty-first mile and the fifty-eighth mile from Seremban] were sufficiently remote from the nearest village or town for the purpose; Malay settlements in the district were few in number and small in size. In connection with these latter it should be remembered that abundant evidence exists to show that Malays in such situations do not suffer from Beri-Beri.

Under the terms of contract the rice issued to these laborers was supplied by the employer. It may be added that the Javanese prefer white rice, which is the kind consumed by them in their own country.

In the early months of 1906 Beri-Beri occurred among them, and in May, June and July of that year it was a serious source of invaliding and mortality. From August 2nd, 1906, the employer, adopting the suggestion of Dr. Braddon, issued only parboiled rice instead of white rice [hitherto issued]; thenceforward it is stated, and this statement is confirmed by the hospital records, no case of Beri-Beri occurred.

Here then the conditions seemed to be in every way suitable for an inquiry into the part played by rice in the causation of Beri-Beri, because these labourers without exception still desired to return to a white rice diet and at this time the evidence of a connection between the consumption of white rice and Beri-Beri was by no means convincing either to the general body of medical and scientific workers or to ourselves. The importance of reaching some conclusion regarding the origin of the disease cannot be over-estimated as the number of its victims in this Peninsula alone runs into many thousands annually.

Throughout these States no labourers other than Tamils will consume parboiled rice unless compelled to do so and while there was any doubt as to the harmful influence of white rice no effective measures could be taken for the suppression of Beri-Beri.

By acceding to the wishes of the group of labourers comprised in this investigation opportunity would be afforded for a thorough testing of the position of dietary factors as causative agents. The labourers were therefore given the option of returning to a white rice diet after it had been fully explained to them that by so doing they ran the risk of contracting Beri-Beri. Without exception they chose the white rice but as for the purpose of comparison two parties were required, half the number only were allowed this diet. It was hoped also that by continuous observation of a large party of men on a parboiled rice diet it might be determined whether, apart from its disagreeable musty odour, any grounds existed for the objections made to the consumption of this rice.

[At the time the investigation was commenced, April, 1907] The 300 labourers were divided into two parties of approximately equal numbers and were housed some miles apart. Before beginning the experiment an examination was made of each person and the presence of cases of existing or recent Beri-Beri was thereby excluded.

To one party white rice (No. 2 Siam) was issued as the staple article of diet, and to the other party parboiled rice. In about three months cases of Beri-Beri began to occur among the members of the party on white rice. When a certain number of cases had been noted white rice was discontinued and thereafter no cases occurred. No sign of the disease appeared among the control party on parboiled rice.

The conditions were then reversed. The party hitherto on parboiled rice were given white rice and after a somewhat longer interval than in the first instance, Beri-Beri broke out in this group also. This outbreak ceased on discontinuing the issue of white rice. Again no sign of the disease appeared among the control party on parboiled rice. By the transfer of individuals suffering from Beri-Beri and of whole groups in which the disease was occurring it was found possible to test the influence of place considered as a nidus of infection and also to test the possibility that the disease was communicable from one individual to another.

The average daily ration was as follows—

Rice	21.3 oz.	603	grammes.
Dried salt fish	4.25 "	120	"
Onions	1.75 "	50	"
Potatoes	1.75 "	50	"
Coconut oil	0.85 "	24	"
Coconut	1.50 "	42	"
Tea	0.12 "	3.4	"
Salt	0.1 "	2.8	"

The symptoms and subsequent histories of the cases which developed beriberi during the course of the investigation are not given in Fraser and Stanton's publication and merely the dates are stated on which the patients developed the disease, though Fraser and Stanton write with regard to party No. 1-B:

It is proper to mention here that in determining whether a given case was to be admitted as a case of Beri-Beri the most rigid exclusion was practised. Only such cases as presented unequivocal signs of the disease were admitted. In every instance the diagnosis was based on the opinion of at least two medical men, in most instances on that of four. Where any doubt was cast upon the accuracy of the diagnosis such case was rejected. The result therefore is that, apart from the cases here recorded, there were many others which, in the opinion of the writers as well as of those associated with them in this inquiry, were really mild or obscure cases of the disease. The difficulties in this respect will be appreciated by those who have had to deal with the disease clinically. No such doubtful case was at any time observed among the people on parboiled rice and the inclusion of cases of this type occurring in the white rice parties in no way strengthens the case for an infectious origin of the disease.

The conclusions arrived at as a result of their inquiry were stated as follows:

Twenty cases of Beri-Beri occurred among 220 people on white rice. No case occurred among 273 people on parboiled rice and under similar conditions to those which obtained in the white rice parties at the time Beri-Beri was prevalent among them.

Since all cases presenting doubtful signs of the disease were excluded we are of opinion that there were many other cases which in the ordinary routine of clinical practice would have been regarded as Beri-Beri. Such cases only occurred among people who consumed white rice. * * *

No case of Beri-Beri occurred in any coolie who had been on white rice for a less period than 87 days.

Systematic examinations were made of the blood and urine of patients suffering from Beri-Beri. Various methods of examination were employed but in no instance were any organisms found, except those well known as the causative agents of other disease.

In the course of the inquiry patients in various stages of Beri-Beri were at times in contact with parties of men on parboiled rice. The results of observations made on such occasions furnished evidence that the disease is not a directly communicable one.

Removal of patients suffering from beri-beri from one place to another did not influence the progress of the disease and removal of entire parties from the place where the disease had occurred did not influence the progress of the outbreak so long as they continued on white rice. These experiments suggest, although they do not prove, that place *per se* or considered as a nidus of infection has no influence upon the development of Beri-Beri.

In three instances in which definite outbreaks of Beri-Beri occurred among parties on white rice, substitution of parboiled rice was followed by a cessation of the outbreak. * * *

No evidence was obtained to show that any article of food other than white rice was a possible source of a causative agent of the disease.

Ankylostomes and other nematode worms were not found in a larger proportion of patients suffering from Beri-Beri than in the general population under observation.

The general results lend support to the view that the disease Beri-Beri as it occurs in this Peninsula, has, if not its origin in, at least an intimate relationship with the consumption of white rice and justify further research along these lines.

Among the many investigators who have brought arguments, based upon experiments, against the rice causation of beriberi may here be mentioned Wright, Durham, Travers, Daniels, and very recently Montel.

Hamilton Wright,⁵⁵ after eleven months' study of the disease in the jail at Kuala Lumpur, states that proof has been obtained that beriberi is independent of diet considered as diet; that the jail itself is a focus in which the virus of beriberi is generated; that evidence has been produced that confirms the view that beriberi is broadly speaking an infectious disease. He further states:

The diet of all prisoners was as physiologically correct as that provided in the Japanese Navy after 1884, and to which is ascribed the disappearance of beri-beri from its personnel by several Japanese authorities, TAKAKI

⁵⁵ Studies from Institute for Medical Research. Federated Malay States (1902), 2, No. 2, 56.

more particularly. In spite of this physiologically correct diet it may be seen (in Tables 21 and 29) that 49 cases originated and 123 re-developed signs of paresis or recontracted the disease during its continuance at the gaol, and that after the regular scales of diet were reverted to there was no increase but rather a decline in the number of cases of beri-beri.

TABLE No. 18.—*Diet scale between May 3, 1901, and January 1, 1902.*

Rice	21	ozs.	daily to all Prisoners.
Buffalo beef	6	"	" " " Malays.
Do. alternatng with pork..	6	"	" " " Chinese.
Mutton	6	"	" " " Tamils.
Two duck's eggs.....		"	" " " Bengalis. and Sikhs.
Vegetables (pump- kin, peas, cabbage, etc.)	7	"	" " " Prisoners.
Towgay or sprout- ing beans	2	"	" " " "
Coconut oil	1	"	" " " "
Curry Stuff	1	"	" " " "
Salt	$\frac{1}{2}$	"	" " " "

Durham⁵⁶ also states:

In the Pudu Jail, patients in the jail hospital were recovering whilst about the cells or work-places their mates were being invalided day by day. They ate of the same rice which was all cooked together.

Durham concluded that the dietetic or physiological or the unsound food theories all appear to be insufficient in accordance with the attending circumstances to have accounted for the spread of beriberi. However, he found from a study of the urine⁵⁷ that the metabolism in beriberi is seriously diminished.

Travers⁵⁸ writes that from the years 1892 to 1894 no cases of beriberi had originated in the Kuala Lumpur jail:

The prisoners were then transferred to a new gaol about two miles away, and in this institution beri-beri broke out in 1895. About 100 prisoners were then sent back to the old gaol, the food with which they were supplied being in every respect similar to that consumed by the prisoners at the new gaol. For the first three months the food was actually cooked in the new gaol and carried to the gaol twice daily. No cases of beri-beri occurred among the prisoners during the nine months spent by them at the old gaol, whereas no less than 323 cases occurred in the new gaol during the same period. The result of this experiment was taken to prove conclusively that, in at any rate this instance, there was no con-

⁵⁶ *Journ. Hyg.* (1904), 4, 112.

⁵⁷ *Brit. Med. Journ.* (1904), 1, 480.

⁵⁸ *Journ. Trop. Med.* (1904), 7, 285.

nection between the rice eaten by the prisoners and the beri-beri from which they suffered.

Some years having elapsed since the date of the above experiment, I thought it advisable to, if possible, confirm the results then arrived at by a somewhat more extensive observation carried out under conditions which would exclude all possibility of error. The institutions selected for observation were the Pudoh Gaol, the Tai Wah Institution and the Leper Asylum.

The Tai Wah Institution is set apart for the care of persons suffering from incurable disease, or who are unable to support themselves. On October 31st, 1902, there were fifty-one patients in the wards, all of Chinese nationality. These Chinamen were, almost without exception, formerly employed as coolies, and were drawn from the same class as the inhabitants of the Pudoh Gaol. Of the fifty-one patients, forty-three, or 84.5 per cent, had been continuously in the hospital for over seven months.

The Leper Asylum is, as its name implies, exclusively set apart for the treatment of lepers. On October 21st, 1902, there were 131 patients in the wards, of which 129 were Chinese and two Tamils. One hundred and eighteen, or 90 per cent, of the inmates had been continuously in the Asylum for more than seven months.

The two hospitals referred to and the Pudoh Gaol are supplied with Rangoon rice by the same Chinese contractor; it is purchased from a merchant in Penang, it is taken delivery of at the Kuala Lumpur Railway Station and is removed to a store in the town. This store is light, clean and well ventilated. The rice is kept on a platform raised from the ground, and is distributed to the various hospitals as required. At no time is more than three weeks' supply kept in the store, and the bags of rice are taken out and sent to the various institutions without selection of any kind.

In the Pudoh Gaol, the Tai Wah Institution and the Leper Asylum we have three institutions, the inhabitants of which are of the same nationality, and the Rangoon rice consumed by them is supplied from the same source, by the same contractor. It would be reasonable to suppose that if the disastrous outbreaks of beri-beri in one of them—the Pudoh Gaol—were caused by a toxin conveyed by Rangoon rice, the patients in the other two—the Tai Wah Institution and the Leper Asylum—should suffer from beri-beri in the same way as the inmates of the prison. This, however, is not the case, and no outbreak of beri-beri has at any time occurred in either the Tai Wah Institution or the Leper Asylum.

From January 1st to October 31st, 1902, 291 fresh cases of beri-beri occurred among the prisoners in the Pudoh Gaol, whereas not a single case of beri-beri occurred among the patients at the Tai Wah Institution or Leper Asylum. *This, I think, disposes of the theory of the connection of beri-beri with the consumption of rice.*⁵⁹ * * *

The Pudoh Gaol has now, after having been scourged by beri-beri for nearly seven years, been free from the disease for seven months. Although there is still some doubt as to the actual cause of the outbreak, it is hoped that our experience of the disease among the prisoners may not have been entirely valueless, and that some hitherto obscure points may have been elucidated by the various observations carried out.

" Italics are mine. R. P. S.

Shibayama⁶⁰ reports that:

In 1908, 1,195 cases of beriberi developed in the Blinjoe, one of the mining districts. Mine No. 3 was especially unfortunate, for 166 out of 410 workmen contracted the disease, and mine No. 4 developed 118 cases among 390. No. 5 had 400 workmen, and 97 of these were ill with beriberi; on the other hand, the remaining mines showed but few cases. For two years the workmen had received unpolished, fresh rice, not only in mines Nos. 3, 4, and 5, but also in No. 11, in which latter 49 out of 300 workmen contracted the disease; on the other hand, the laborers in the remainder always had polished and old rice. It may further be stated, according to Hulshoff-Pol, that the workmen in all the mines received 150 grams *kadjang idjo* beans, together with dried fish and fresh vegetables, daily. The result of our observations, therefore, was as follows:

1. Even if the workmen in the mines receive 150 grams of *kadjang idjo* regularly every day, nevertheless beriberi occurs among them.

2. Even if the laborers are given a diet of fresh, unpolished rice, nevertheless they develop more cases of beriberi than those in the other mines, where they receive polished and older Java rice.

I therefore could not find the assumption to be confirmed that unpolished rice, which has the same composition as parboiled rice, could prevent beriberi. * * *

All my observations lead me to the conclusion that uniform, but little changing, monotonous diet predisposes to the disease. The condition of nourishment of the Chinese in two of the mines of Banka was fairly good, the total quantity of the chief constituents of diet, namely, protein, fat and carbohydrates, was sufficient, but the diet was always one-sided and not varied throughout the year. This is also true of the general epidemic of beriberi aboard the steamship referred to above, and in the fishing villages the one-sided diet was the only point to be observed.

However, the one-sided or monotonous diet is only the predisposing cause of beriberi; the true cause must be sought in other directions. * * *

Montel,⁶¹ at the meeting of the Far Eastern Association of Tropical Medicine held during the present year, reports the occurrence of an epidemic of beriberi near Saigon which could not be entirely explained by the so-called rice origin of the disease. He calls attention to an instance in a monastery and a convent where the conditions were more or less the same and yet in one beriberi frequently occurred while in the other outbreaks of the disease were never known. The monastery and convent were located in the same area of the town and were only separated by a small stream. In the monastery rice was consumed a few days after it was hulled and no case of beriberi occurred. In the convent much the same rice was used, but large quantities were hulled at a time and stored, and in this institution beriberi outbreaks were quite common.

⁶⁰ *This Journal*, Sec. B (1910), 5, 124.

⁶¹ *Med. Rec.* (1912), 81, 630.

At the same meeting Davis⁶² presented a paper which lent evidence favoring the infectious theory of the disease. The prisoners in the Shanghai Jail at one time suffered severely from beriberi which diminished, it is true, with a change in diet but again reached a high figure when the improved sanitary conditions due to a coincident occupancy of a new jail had in time deteriorated. When steps were taken to overcome infestation with vermin, the incidence of the disease again diminished markedly.

To enter into a discussion of the literature regarding epidemics of beriberi among people who never eat rice would lead us too far astray in our argument in relation to the etiology of tropical beriberi.

However, in this communication attention may be called to the investigations of Axel Holst⁶³ in relation to the occurrence of beriberi on Norwegian ships. This author points out that the frequency of beriberi, under these conditions, coincides with certain alterations in the food during long voyages, and he reports the production of polyneuritis gallinarum in fowls by feeding tinned meats, which have been boiled for one-half an hour at a temperature of 110° C., and even sometimes by feeding salt meat, somewhat tainted, boiled for one hour at 100° C.

It is not our intention to criticize here the conclusions reached by these investigators from their experiments which we have quoted, but merely to call attention to the fact that considerable evidence has been presented by various authors against the idea that the continuous consumption of white rice as a staple article of diet is the cause of beriberi. In fact, in a number of other outbreaks of beriberi which have occurred recently, the evidence submitted has been entirely opposed to the idea of the rice causation of beriberi. However, it must be admitted that in regard to the cause of these outbreaks the evidence is no more complete or convincing than is that given in the articles already referred to and therefore it will not be quoted here. A number of physicians in Manila and elsewhere, who have had a wide experience with beriberi, still decidedly oppose the idea that the disease is due to the prolonged consumption of polished rice as the staple article of diet.

From the consideration of the literature on this subject, as outlined in this article, it will be clearly seen that no experiments

⁶² Quoted by *Journ. Am. Med. Assoc.* (1912), 58, 1859.

⁶³ *Journ. Hyg.* (1907), 7, 619; *Trans. Soc. Trop. Med. & Hyg.* (1911), 5, 71.

in which an infectious agent as the cause of the disease has been excluded in any way as near as rigid a manner as in those of Fraser and Stanton have been performed. However, the contributions of Ellis,⁶⁴ Hight,⁶⁵ Chamberlain,⁶⁶ and particularly of Heiser⁶⁷ are all very valuable from an epidemiological standpoint and lend considerable additional support to the view that beriberi is caused by the prolonged use of polished rice as a staple article of diet.

Castellani,⁶⁸ in considering the experiments of Fraser and Stanton states:

The isolated position in which the gangs were working almost excluded any possibility of infection from place or from persons, but not quite from the latter.

As Fraser and Stanton both point out in their later publication,⁶⁹ the whole Malay Peninsula has long been known as an endemic focus of beriberi, and the mortality rates from this disease have been enormous there for several decades.

Wright⁷⁰ also remarks there is no better place than the Malay Peninsula in which to investigate this disease.

Fraser and Stanton in their article also write:

At this time, evidence of a communication between the consumption of white rice and beri-beri was by no means convincing either to the great body of medical and scientific workers or to ourselves,

and at the conclusion of their article, detailing their experiments on human beings, they state that their experiments appear to justify further research along these lines.

At the meeting of the Far Eastern Association of Tropical Medicine in 1910 a resolution was passed calling the attention of the various governments concerned to the fact that sufficient evidence has now been produced in support of the view that beriberi is associated with the continuous consumption of white (polished) rice as a staple article of diet. There was considerable opposition to the passage of this resolution in this form on the ground that it was not sufficiently conservative from a scien-

⁶⁴ *Loc. cit.*

⁶⁵ *This Journal, Sec. B* (1910), 5, 73.

⁶⁶ *This Journal, Sec. B* (1911), 6, 133.

⁶⁷ *This Journal, Sec. B* (1911), 6, 229; *Annual Rep. P. I. Bur. Hlth.* (1910); *Journ. Am. Med. Assoc.* (1911), 56, 1237.

⁶⁸ Castellani and Chalmers, *Manual of Tropical Medicine* (1910), 890.

⁶⁹ Studies from Institute for Medical Research. Federated Malay States (1911), No. 12, 1.

⁷⁰ *Loc. cit.*

tific standpoint in relation to our present knowledge at the time. In fact, its passage was only secured at a final business meeting after the association had adjourned from Manila to Baguio, the summer capital of the Philippines, and at which meeting only a portion of the members of the association were present. Near the close of the year, 1910, the question of passing a law placing a tax upon all imported polished rice was considered by the Government of these Islands, but, owing to the fact that there was still considerable difference of opinion expressed regarding the definite etiology of the disease in relation to rice alone, the question was temporarily postponed. It was then decided by one of us to carry out as careful a test of this question as was possible.

In the year 1910 the etiology of beriberi was still to such an extent an open question that the Société de Pathologie Exotique through its president, M. Roux, director of the Pasteur Institute, appointed a committee⁷¹ to investigate the subject and to collect information in the countries where beriberi existed.

The researches which will be here recorded were planned during the year 1910 and commenced at the beginning of the year 1911; but, owing to the hurried departure of one of us to Manchuria, it was necessary to discontinue them and to postpone them until the beginning of the present year.

CONDITIONS UNDER WHICH THE EXPERIMENTS WERE PERFORMED.

The object of our study was to determine definitely, if possible, whether beriberi, as it occurs in the Philippine Islands, is an infectious disease or whether it is one which has its origin in disturbances in metabolism, brought about by the prolonged use of polished rice as a staple article of diet. The experiments were carried out in Bilibid Prison in which institution the hygienic conditions may be said to be almost ideal. The area inside the prison walls comprises 3.43 hectares (8.5 acres); the average number of inmates is 3,000, but the subjects upon which our experiments were performed were entirely isolated, and no case of beriberi had been known to occur among them since their confinement. Individuals who have been sentenced to im-

⁷¹ This committee was composed of MM. Bréaudat, le Dantec, Jeanselme, Kermorgant, Marchoux, and Pottevin and its report did not reach us until after our experiments were commenced. The important researches which have been performed by various investigators upon the subject are recorded in this excellent report and the theory of the dietetic origin of the disease endorsed. See *Bull. Soc. path. exotique* (1911) (Nov. and Dec.), 4, 575, 656.

prisonment on entering the institution undergo a quarantine of five days, and, if found to be suffering from any disease, are subsequently kept in the prison hospital and are not permitted to return to the general prison centers until well. The discipline of the prison is very strict.⁷²

The nature of the experiments having been outlined and the Government having given its sanction to the same, a number of prisoners, under sentence of death, were selected and the nature of the proposed experiments carefully explained to them in their own dialect. They were told that the experiments were for the purpose of testing the comparative value of different kinds of rice as a food; the articles of food comprising the diet that would be given to them were enumerated, and they were also told that perhaps they might contract beriberi. The proposition was stated to them clearly. In addition, they were to be allowed an abundance of cigarettes of any kind that they wished, and also cigars if they desired them. Volunteers were then asked for. Twenty-nine of the number volunteered. The remaining ones did not care to undertake the experiment. Each of the volunteers then signed a statement, written in his own dialect, stating that he undertook the experiment entirely voluntarily and that he would agree to continue with the experiment until it was completed. This having been accomplished, the volunteers were divided into 4 groups. Three of the groups were placed in a *bartolina* or small inner prison on one side of the institution, known as the *presidio* side. The fourth group was placed in a *bartolina* on the other side of the prison known as the *carcel* side. The two *bartolinas* are a considerable distance (72 yards) apart. There are three high stone walls between them, one measuring about 4.8 meters in height, and two 3.6 meters in height; there is no approach to either except through the entrance to the prison, and this is situated a considerable distance from each. The location of the *bartolinas* may be seen upon reference to the plan. (See Plate I, A and B.) The *bartolinas* are alike in structure. They are surrounded by stone walls, 3.6 meters in height; there is but a single entrance through a high iron gate and but one key to the gate, and this was in the possession of an American guard. No one could enter or leave the *bartolina* without this American guard being present. Other

⁷² We wish to express particularly our thanks to Colonel Dorrington, director of the Prison, Inspector Rabb, Doctor Smith, Mr. Henshaw, and Mr. Milbrodt for many courtesies and much assistance during the course of the experiments.

guards continually watched the gate. Toward one end of the quadrangle formed by the walls of the bartolinas a stone cell house is situated, consisting of five rooms (see Plate II), each with a separate entrance. The walls of the five cells are of stone, the floors of cement. Ventilation is obtained through iron-barred windows and through the roof, and in the day time through the doorway. In each prison cell, besides the beds, constructed of an iron frame covered with canvas, was a porcelain flush water-closet with running water and a large receptacle kept locked containing distilled water for drinking purposes. (See Plate III.) A shower bath was situated in the courtyard. The rooms were always kept scrupulously clean and the hygienic arrangements were excellent. Each group of the subjects of the experiments was assigned to one of these rooms of the cell house and was locked in it at night. In the morning each prison cell was unlocked and during the day all the subjects of the experiments in one bartolina were allowed to mingle freely with one another, except at meal times. During the meal time the different groups ate in separate rooms under the observation of one of us or occasionally under the observation of the American guard, so that it was quite impossible for any interchange of food between the different groups to occur. At the close of the meal each man turned in his pail containing the amount of food uneaten and a record of the amount was entered in the notes. None of the prisoners was allowed to retain any of the uneaten food except in one or two instances noted under the histories of each individual case. The conditions of the isolation of the men as is obvious were such as to preclude the possibility of any other food reaching them in any way or at any time. Groups I, II, and III were confined in Bartolina A and Group IV in Bartolina B.

THE DIET EMPLOYED IN THE EXPERIMENTS.

The food used was weighed for each meal and cooked outside of the prison in a special kitchen by a special cook, in a clean manner, and under very careful supervision. After cooking it was divided into equal parts according to the number to be fed. At first it was divided by weight, but it soon became possible to estimate sufficiently accurately the division into equal parts. Each man's food was put into a special dinner pail marked with his number and so served to him. A record was taken at the close of each meal of the amount eaten by each man; it was

estimated in fractions of the amount served and expressed in grams. The rice was served hot; it was, of course, always freshly cooked for each meal as were all the articles of the diet. The meals served were as follows:

TABLE I.—*Diets employed.*

Breakfast.			
Bread about 100 grams.			
Coffee about 500 cubic centimeters.			
Sugar about 15 grams.			
Dinner I.	Grams.	Supper I.	Grams.
Rice	300	Rice	350
Bacon	50	Onions	150
		Lard	20
Dinner II.		Supper II.	
Rice	300	Rice	300
Onions	100	Bacon	50
Lard	15		
Dinner III.		Supper III.	
Rice	300	Rice	300
Bananas	100	Bananas	150
Sugar	25	Sugar	75
Dinner IV.		Supper IV.	
Rice	200	Bread	200
Bread	150	Rice	100
Bacon	30	Starch	50
		Sugar	25
Dinner V.		Lard	20
Rice	100		
Bread	150		
Starch	50		
Sugar	25		
Lard	20		

It soon became evident that it was impossible to serve dinner No. V and supper No. IV in an acceptable form to the subject of the experiment and, therefore, these were eliminated. The other diets were alternated.

On the ninety-seventh day of the experiment with Groups I, II, and III and on the eighty-first day with Group IV, 100 grams of potatoes and 30 grams of dried codfish were added to the diet and these articles were served at intervals with 300 grams of rice in rotation with the other meals. The following table gives the percentage of phosphorus pentoxide and of the nitrogen in the articles of diet employed throughout the experiment.

TABLE II.—*Composition of foods used in the experiment.*

Kind of food.	P ₂ O ₅ .	N.
	<i>Per cent.</i>	<i>Per cent.</i>
Bacon.....	0.21	0.7
Onions.....	0.7	1.8
Codfish (dried).....	2.9	10.58
White rice (la blanco).....	0.37	1.25
Red rice (pinawa).....	0.69	1.16
Starch.....	trace	0.18
Rice polishings (darác).....	4.47	1.8
Sugar.....	trace	2.11
Potatoes.....	0.23	0.31
Alcoholic extract of rice polishings.....	0.025	0.365

NATURE OF THE RICE EMPLOYED.

All the subjects of the experiment received exactly the same diet, except in regard to the kind of rice. As the experiment was originally planned, it was proposed to feed three groups as follows:

- I. White rice + rice polishings.
- II. White rice + alcoholic extract of rice polishings.
- III. White rice alone.

However, after a few days it was found impossible to persuade any of the individuals to eat further the rice mixed with the polishings or to prepare the polishings so that they would be eaten. Although they were not informed what they were being served to eat, they detected at once that the polishings were mixed with the rice. They were persuaded to eat some of it for a few days, then they persistently refused to partake of it, even though they began to suffer from marked hunger, insisting that it caused gastric disturbances and soreness in the pharynx. The polishings were, of course, uncooked and were mixed with the rice after it was cooked in order that there might be no opportunity for the criticism that the protective substances in the polishings had been destroyed by heat. As there was no object in continuing the experiment if the members of this group (No. I) did not eat the rice, we placed them upon red (*pinawa*) rice.⁷³

The white polished rice employed throughout our experiments was especially milled and polished for us by Messrs. Smith, Bell, & Co., Ltd. of Manila at their new mills, and the samples contained 0.37 per cent of phosphorus pentoxide. The rice

⁷³ Throughout this article the term "white rice" will be used to indicate the highly polished rice and the term "red rice" the unpolished rice.

polishings employed at first mixed with the rice and also for the purpose of making the alcoholic extract that was used throughout the experiment were also especially prepared by this firm and were free from grain weevils. The commercial polishings for sale in the markets always contain weevils in great abundance, and it is very difficult or impossible to separate them from the polishings.

PREPARATION OF THE EXTRACT OF RICE POLISHINGS EMPLOYED.

The extract of the polishings was prepared by Mr. Hocson of the physiological laboratory of the College of Medicine and Surgery to whom we wish to express our thanks. The extract was always freshly prepared every third day and used before any deterioration could have occurred. The method of preparation employed, which was essentially that of Chamberlain and Vedder,⁷⁴ was as follows:

Five kilograms of rice polishings (*darác*) were extracted with 14,000 cubic centimeters of 95-per-cent alcohol by three successive macerations of twenty-four hours each, using for the first day 6,000 cubic centimeters and for the second and third 4,000 cubic centimeters respectively. After each day of maceration the liquid was strained, pressed, filtered, and the filtrate transferred to a porcelain dish to facilitate the evaporation of the alcohol of which there was a large amount present, a portion of the alcohol was evaporated more rapidly by means of an electric fan and the fat separated from the extract. The extract was then concentrated to 125 cubic centimeters in vacuum at 60°C., and the residue obtained was made up in volume to 625 cubic centimeters with distilled water and filtered.

EXPERIMENT.

We shall now proceed to consider the experiments in detail. The nature of the rice received by each individual is stated at the beginning of the summary of his history during the experiment. In general, it may be mentioned that the groups were fed for the greater part of the time occupied by the experiments as follows:

- Group I. White rice + extract of rice polishings + special diet.
- Group II. White rice + special diet.
- Group III. Red rice + special diet.
- Group IV. White rice + special diet.

For about the first thirteen days Group I were fed white rice mixed with the rice polishings, as we had not sufficient extract on hand to begin the experiment with this group; and Group III for the first seventeen days were fed white rice mixed with

⁷⁴ *This Journal*, Sec. B (1911), 6, 254; (1912), 7, 40.

rice polishings, red rice being then substituted, for the reasons already stated.

The experiments were continued for as long a period as practicable. When a prisoner insisted upon being returned to the regular prison ration or his condition became such that such a change of diet seemed advisable, the experiment in his case was discontinued.

Several attempts were made to secure skiagrams of the hearts of the individuals, but the electric instalment in the prison was such that satisfactory X-ray photographs for publication could not be secured. For the same reason the testing of the electrical reactions of the patients, which was attempted during the experiment, was unsatisfactory, and we could not secure a satisfactory, suitable, and portable electric apparatus for this purpose in Manila. As these prisoners were all under sentence of death, they could not be taken outside of the prison for any purpose. The prisoners are referred to by numbers. With the history of each case is given a curve of the weight during the experiment and there is placed after the last case in each group a table showing the amount of food consumed each day. All of the prisoners were healthy at the time of the beginning of the experiment and had been under observation for some weeks. None of them gave a history of having suffered with beriberi previously. A summary of the important features of the history of each individual who partook of the diet will now be considered.

SUMMARY OF THE RECORDS OF THE CASES OF GROUP I.

CASE NO. 1 (GROUP I).

Diet: White rice + rice polishings ¹⁶ for 13 days followed by white rice + extract of polishings for 95 days, together with the special diet common to all the groups.	}	Total period of experiment, 108 days.
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Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: The examination showed an apparently healthy individual; percussion and auscultation of the chest revealed no abnormality of the lungs; the examination of the heart showed no increase in the area of cardiac dulness beyond the normal limits; the point of

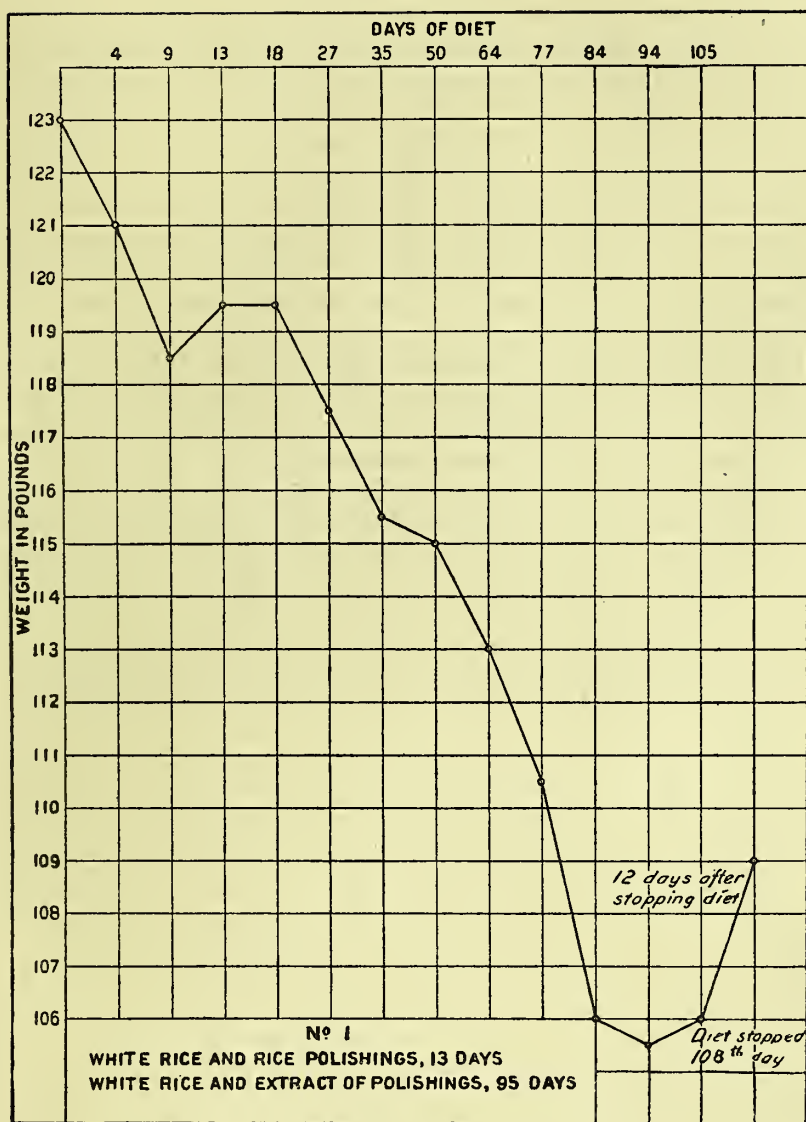
¹⁶ The cases in Group I were fed rice polishings for 13 days as a sufficient amount of the fresh extract of polishings was not prepared at that time with which to begin the experiment satisfactorily.

maximum impulse was invisible; it was palpable 5.5 centimeters to the left of the median line and 3 centimeters below the nipple line; the heart sounds were clear at the apex and base; there was no visible epigastric pulsation; the pulse was 82, and the systolic blood pressure 124 millimeters of mercury⁷⁶ (Faught); the area of liver dulness was not increased; the spleen was not palpable; the knee jerks were active.

The subject soon objected to the taste and odor of the rice mixed with the polishings and lost in weight. As soon as a sufficient amount of fresh extract of polishings was prepared, this was substituted for the polishings themselves. However, while after a time he ate more, he continued to lose in weight. (See accompanying chart.) Reference to the table placed after the last case of the group on p. 308 will show the amount and kind of food consumed each day. The earlier notes in regard to the case are otherwise unimportant. On the eighty-first day of diet, the knee jerks were found to be very active. He complained slightly of cloudiness of vision. On the eighty-fifth day of diet he remained in bed and complained of pain in the abdomen and neck. The knee jerks were still very active. The voice was husky. The pulse, when standing, was 160, and epigastric pulsation was present. The point of maximum impulse was still invisible. The heart sounds were clear. There was very slight œdema of the legs and slight pain in the calves of the legs. Pain was elicited on pressure. The skin was moist and cool, but he stated that he felt hot. No distinct areas of anæsthesia of the skin were discovered. There was no fever. On the eighty-seventh day the patient was still in bed. The voice was very weak and husky, at times whispering, and he complained of numbness of the fingers and tenderness of the calves of the legs. The knee jerks were active. On the ninetieth day of diet he seemed better. On the ninety-fifth day the knee jerks were active, the voice was still very weak and harsh. There was no cough, no sore throat, nor other evidences of a laryngitis, and no pain in the throat. Owing to the many complaints received from this prisoner undergoing the experiment regarding his diet, and to his loss in weight, and that of a number of the other prisoners comprising this group, the prison authorities felt that it was necessary to give them additional articles of food. Therefore, dried codfish and potatoes were added to the diet. On the ninety-eighth day the voice seemed a little stronger.

⁷⁶ Hereafter in the paper, the symbol Hg will be used for mercury.

The pulse was 104, and the knee jerks very active. On the ninety-ninth day the note made was as follows: Pulse, 100; slight visible epigastric pulsation; no visible throbbing over cardiac area; the point of maximum impulse is visible and palpable just within the nipple line; the heart sounds are clear; the hoarseness is still present, but the voice is no longer whispering; the œdema has disappeared considerably and is no longer distinct; there is no pain nor tenderness of the legs; the knee jerks are active. Beginning on the one hundred third day, 20 cubic centimeters of the extract of polishings were given daily in water in addition to the usual amount of 40 cubic centimeters mixed with the rice. Owing to the general dissatisfaction among the individuals undergoing the experiment regarding the continuance of the diet, the prison officials felt that these prisoners should be allowed to return to the regular prison ration. It, therefore, became necessary to discontinue the experiment on the one hundred eighth day. The note made on the case on this day reads: Subject fairly well nourished; pulse 84, regular and of good volume; respirations normal; moderate epigastric pulsation; point of maximum impulse visible 6 centimeters to the left of the median line and 3 centimeters below the nipple line; no visible pulsation over the rest of the cardiac area; area of cardiac dulness not apparently increased beyond the normal limits; the heart sounds are clear; the conjunctivæ are of fairly good color; he complains of no pain in the calves of the legs, and there is no tenderness on pressure; there is no œdema of the legs, and the knee jerks are very active; the voice is still somewhat husky, but there is no pain in the throat. He says he feels well, but on closer questioning says that he was much stronger before he began the diet. The urine contains no albumin and no casts. The patient was placed on the regular prison ration (see Table III) and in twelve days had gained 4 pounds. His voice gradually became normal, and he has since been well. A diagnosis of beriberi was not made in this case. Nevertheless the symptoms were suggestive of this disease. While it is a well-known fact that all cases of beriberi do not show loss of knee jerks, nevertheless, in an experiment of this nature, a definite diagnosis of beriberi was not made unless the knee jerks had disappeared in addition to the occurrence of other symptoms of this disease. It is impossible to state definitely what would have occurred had the original diet been persisted in for a longer period of time.



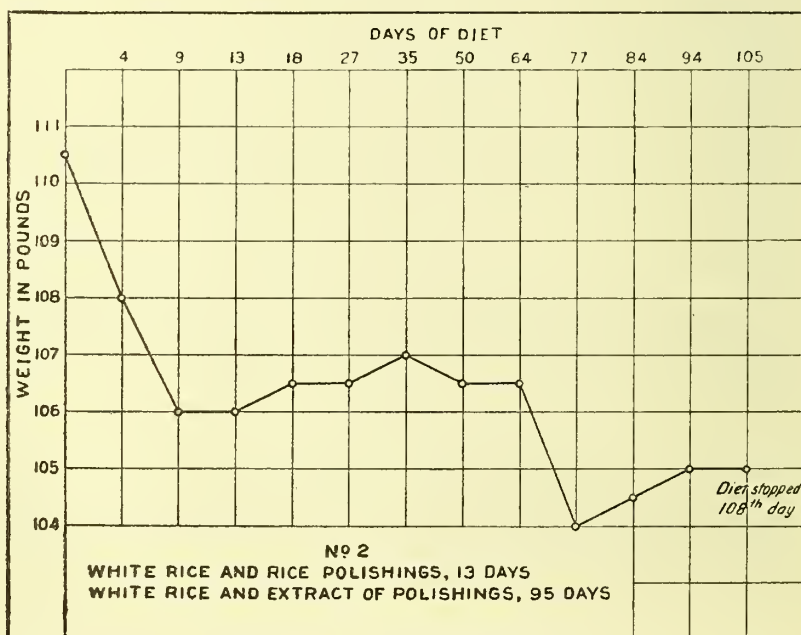
CASE NO. 2 (GROUP I).

Diet: White rice + rice polishings for 13 days
 followed by white rice + extract of polish-
 ings for 95 days, together with the special
 diet common to all the groups. } Total period of experi-
 ment, 108 days.

Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes on the case: Individual fairly well nourished; the examination of the lungs reveals nothing abnormal; the examination of the heart shows the area of cardiac dulness is not increased beyond the normal limits; the point of maximum impulse is not distinctly visible, but is palpable 6.5 centimeters from the midsternal line and 0.75 centimeter below the nipple line; the heart sounds are clear at the apex and base; there is no visible epigastric pulsation; the pulse is 108, and the systolic blood pressure 128 millimeters Hg (Faught); the spleen and liver are apparently not enlarged; the knee jerks are active.

The patient lost 2.04 kilograms (4.5 pounds) during the first two weeks of the experiment. After the substitution of the extract of polishings for the polishings themselves mixed with the rice, his weight remained about stationary, until about the sixty-fourth day of the experiment, when he again lost slightly in weight. His condition remained fairly good, however, and the notes made in regard to him during this time were otherwise unimportant. The knee jerks remained active. On the eighty-fifth day of diet the systolic blood pressure was 90 millimeters Hg. On the ninety-ninth day the following note was made: The heart sounds are rapid but clear; pulse, 114; no visible throbbing over cardiac area. There is no œdema of the legs and no



complaint of pain. The knee jerks are active. The condition of the patient continued about the same. On the one hundred eighth day of diet when it became necessary to discontinue the experiment, owing to the reasons already stated under the previous case, the following note was made: Subject rather sparsely nourished; pulse, 104 and of fair volume; quite moderate epigastric pulsation; no visible throbbing over cardiac area; apex beat not distinctly visible and indistinctly palpable. Area of cardiac dulness not increased. The heart sounds are clear. The tongue is clean and the conjunctivæ of good color. There is no pain nor tenderness of the legs and no œdema of the legs. The knee jerks are active. He says he feels weaker than at the beginning of the experiment. The urine contained no albumin nor casts.

CASE NO. 3 (GROUP I).

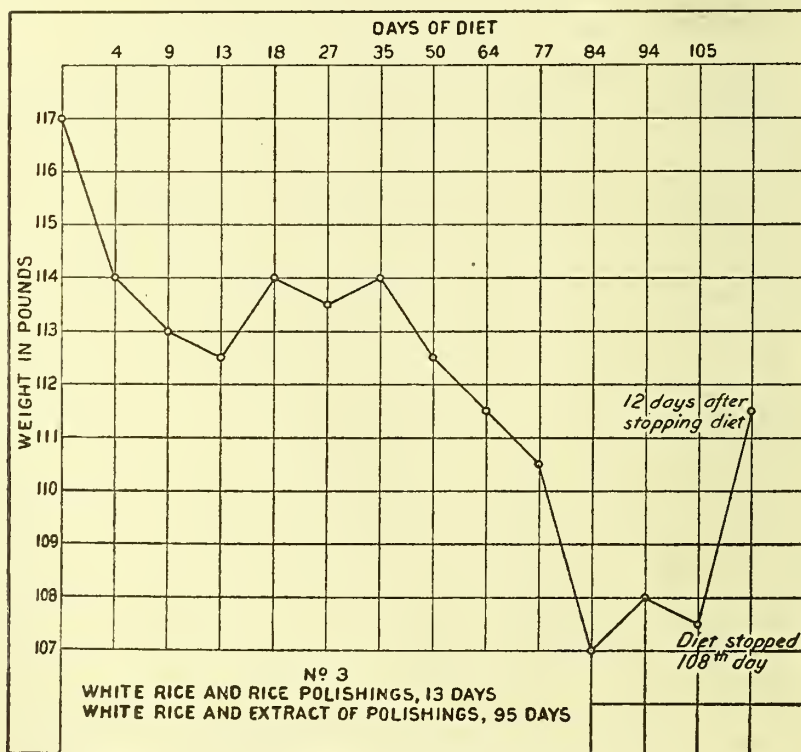
Diet: White rice + rice polishings for 13 days followed by white rice + extract of polish- ings for 95 days, together with the special diet common to all the groups.	}	Total period of experi- ment, 108 days.
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Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: The subject is fairly well nourished; percussion and auscultation of the lungs reveals nothing abnormal; on examination of the heart, the area of cardiac dulness is not increased; the point of maximum impulse is invisible, but is palpable 7 centimeters to the left of the median line and 1.5 centimeters below the nipple. The pulse is 84, and the systolic blood pressure 110 millimeters Hg (Faught). There was no epigastric pulsation. The liver and spleen were not enlarged. The knee jerks were active.

The patient lost steadily in weight, but the notes of his condition during the earlier part of the experiment are otherwise unimportant. By the eighty-first day he had lost 4.5 kilograms (10 pounds). On this day he remained in bed, complained of being sick, and refused to eat. His temperature was normal (37° C.), pulse 112, respiration 28. He complained of headache and pain in his stomach and stated that he had vomited twice during the night. There was slight visible epigastric pulsation, but no throbbing visible over the cardiac area. On the eighty-second day at noon the pulse was 78. He was eating but little. He complained of severe headache. At 4 o'clock in the afternoon he was still sick, pulse 109. He complained of pain in his stomach and of pulsation in his abdomen. On the eighty-third day at noon he seemed weak, his pulse was

88. At 4 o'clock in the afternoon, pulse 80. He complained of headache and of pains in the calves of his legs. On the eighty-fourth day his pulse was 100, respirations 24. He complained of marked pain in the calves of his legs and of tenderness on pressure. The knee jerks were active. Epigastric pulsation was visible. There was no throbbing over the cardiac area. The examination of the heart showed no definite changes. On the eighty-fifth day at noon the note made was as follows: He complains chiefly of pain in the calves of the legs. Pulse, 96; visible epigastric pulsation still present; the knee jerks are very active; the systolic blood pressure is 95 millimeters. Eighty-seventh day, still complains of pain in the abdomen, calves of legs, and head. By the ninety-fifth day the voice had become husky. On the ninety-seventh day he developed marked conjunctivitis. Dried codfish and potatoes were added to the diet on this day. On the ninety-ninth day the note shows that the huskiness of the voice continued. The heart sounds remained clear; there was no throbbing over the cardiac area and no



œdema of the legs; the pulse was 88; the knee jerks were active; the conjunctivitis was treated. On the one hundred fifth day the condition of the eyes was improving. For the reasons already stated under case No. 1, it became necessary to discontinue the experiment. On the one hundred eighth day the note made was as follows: The nutrition is fair; pulse 94 and of good volume; moderate epigastric pulsation; point of maximum impulse not distinctly visible nor palpable; no increase in the area of cardiac dulness; first heart sound somewhat prolonged at apex; no distinct murmur; the pain and tenderness in the legs has disappeared; there is no œdema of the legs; the knee jerks are active; the voice is still somewhat harsh, and the conjunctivitis marked; he says he feels weaker than before the experiment; he has lost 4.5 kilograms (10 pounds) during the experiment; the urine is normal. Twelve days after being placed upon the regular prison ration he had gained 1.8 kilograms (4 pounds); his voice gradually resumed its normal tone. Possibly this prisoner also had already symptoms of beriberi.

CASE NO. 4 (GROUP I).

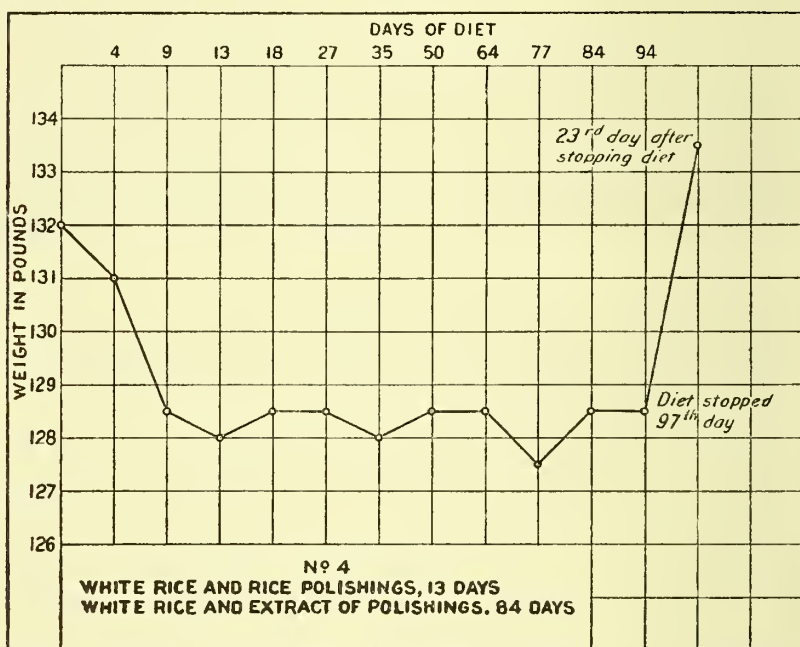
Diet: White rice + rice polishings for 13 days followed by white rice + extract of polish- ings for 84 days, together with the special diet common to all the groups.	}	Total period of experi- ment, 97 days. ¹⁷
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Following is a summary of the notes of the case: Well-nourished man; expansion of chest good; auscultation and percussion of lungs normal; examination of heart shows no increase in area of dulness beyond the normal; point of maximum impulse invisible and just recognizable on palpation, 8 centimeters to left of median line and exactly in the nipple line; the heart sounds are clear at both apex and base; there is no special accentuation of either second sound at the base, though the second aortic seems sharper in the second interspace; there is no epigastric pulsation; the pulse is 80, and the systolic blood pressure 140 millimeters.

The prisoner lost a few pounds in weight during the first two weeks of the experiment, as did the other members of the group. The earlier notes are unimportant regarding his condition. The knee jerks remained active. He gained 2.2 kilograms (5

¹⁷ This prisoner refused to continue the diet after ninety-seven days and was returned to the regular prison ration at the request of the prison authorities.

pounds) in twenty-three days following the change of diet from polishings mixed with the rice to alcoholic extract of polishings. On the eighty-fifth day of diet the systolic blood pressure was 100 millimeters Hg. A few small erosions developed about the corners of the lips during the experiment which healed promptly under local applications of a 5 per cent solution of silver nitrate. He refused to continue the diet on the ninety-seventh day of the experiment and was returned to the regular prison ration on that day. At this time his condition appeared good and his knee jerks were active.



CASE NO. 5 (GROUP I).

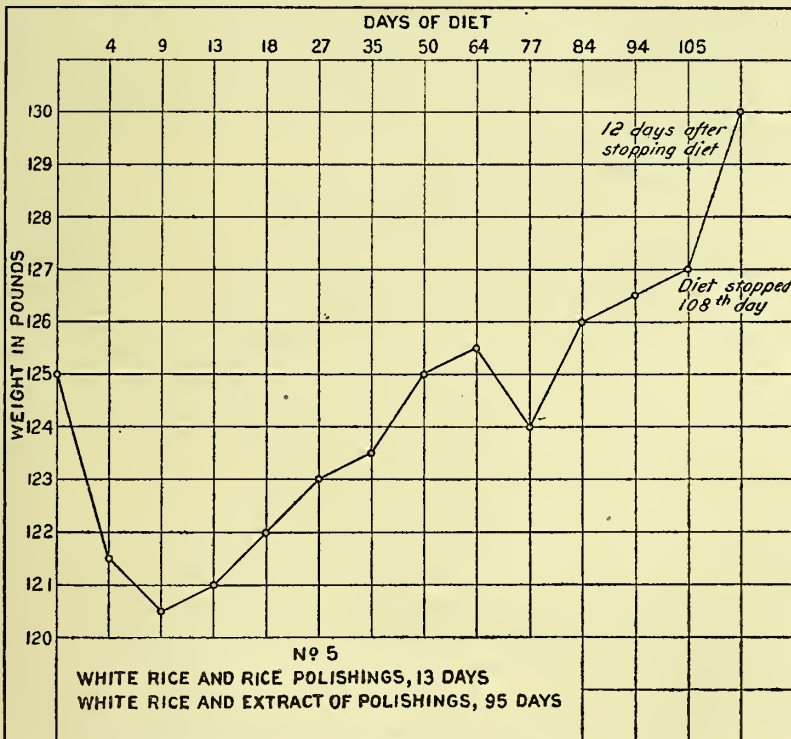
Diet: White rice + rice polishings for 13 days
 followed by white rice + extract of polishings for 95 days, together with the special diet common to all the groups. } Total period of experiment, 108 days.

Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: He states that he is 67 years old; his knee jerks are absent; examination of the lungs shows moderate emphysema; the examination of the heart shows that the area of cardiac dulness does not extend to the right of sternum, while on the left it extends 2.5 centi-

meters outside of nipple line. The point of maximum impulse is invisible; it is indistinctly palpable 8 centimeters to the left of median line and 3.5 centimeters below the nipple line; there is no epigastric pulsation; the pulse is 104 and the systolic blood pressure 144 millimeters Hg; the heart sounds are clear but somewhat enfeebled; the liver and spleen are not enlarged.

The patient lost about 1.8 kilograms (4 pounds) in weight while upon the rice mixed with the polishing, but, upon being placed on the rice with the extract, he began to gain in weight and continued to do so up to the time of the end of the experiment. The earlier notes regarding him are unimportant. On the eighty-fifth day the systolic blood pressure was 120 millimeters Hg. On the ninety-ninth day the note made was as follows: Pulse slow and regular, rather weak; no throbbing over cardiac area; no epigastric pulsation; heart sounds clear; no œdema of the legs; knee jerks absent; his condition remained about the same. At the end of the experiment on the one hundred eighth day, the note read as follows: Point of maximum



impulse not visible nor distinctly palpable; heart sounds feeble but clear; second aortic sound accentuated at the base; no œdema of the legs, and no tenderness of the calves; says he feels weaker than before taking the diet, but he weighs 0.9 kilogram (2 pounds) more than before the experiment. The urine contained no albumin nor casts. Twelve days after his return to the regular prison ration he had gained 1.3 kilograms (3 pounds) more.

CASE NO. 6 (GROUP I).

Diet: White rice + rice polishings for 13 days followed by white rice + extract of polish- ings for 95 days, together with the special diet common to all the groups.	}	Total period of experi- ment, 108 days.
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Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: Examination shows a well-developed and well-nourished man; percussion and auscultation of the lungs reveals nothing abnormal; examination of the heart shows the point of maximum impulse not distinctly visible; just palpable 6 centimeters to the left of the median line and 3 centimeters below the nipple line; there is no increase in the area of cardiac dulness; the heart sounds are clear; there is no epigastric pulsation; the pulse is 80, and the systolic blood pressure 114 millimeters Hg; the liver and spleen are not enlarged; the knee jerks are active.

He lost 4.08 kilograms (9 pounds) in weight during the time he was fed on rice mixed with the polishings, but when the extract of polishings was added to the rice instead of the polishings, he regained about 0.9 kilogram (2 pounds). The earlier notes in regard to him are otherwise unimportant. The knee jerks remained active. On the eighty-fifth day the systolic blood pressure was 95 millimeters. On the ninety-ninth day epigastric pulsation was visible, but there was no throbbing over the cardiac area; the point of maximum impulse was not visible, but was just palpable within the nipple line; the heart sounds were clear, and the pulse slow and regular; there was no œdema of the legs; the knee jerks were active. The prisoner made no complaints except of small erosions on the edge of the lips and on the tongue. On the one hundred fifth day there was no particular change in his condition. The erosions about the mouth had improved by application of a 5-per-cent solution of silver nitrate. On the one hundred eighth day the note made was as follows: Fairly well nourished; pulse 100, and of good volume; some epigastric

pulsation; no throbbing over the cardiac area; point of maximum impulse not visible nor distinctly palpable; heart sounds clear; no pain nor tenderness of the legs; no œdema of legs; the knee jerks are active; he says he feels about the same as before he began the diet; the urine contained no albumin nor casts. He was placed on the regular prison ration, but thirteen days later he had not gained in weight.

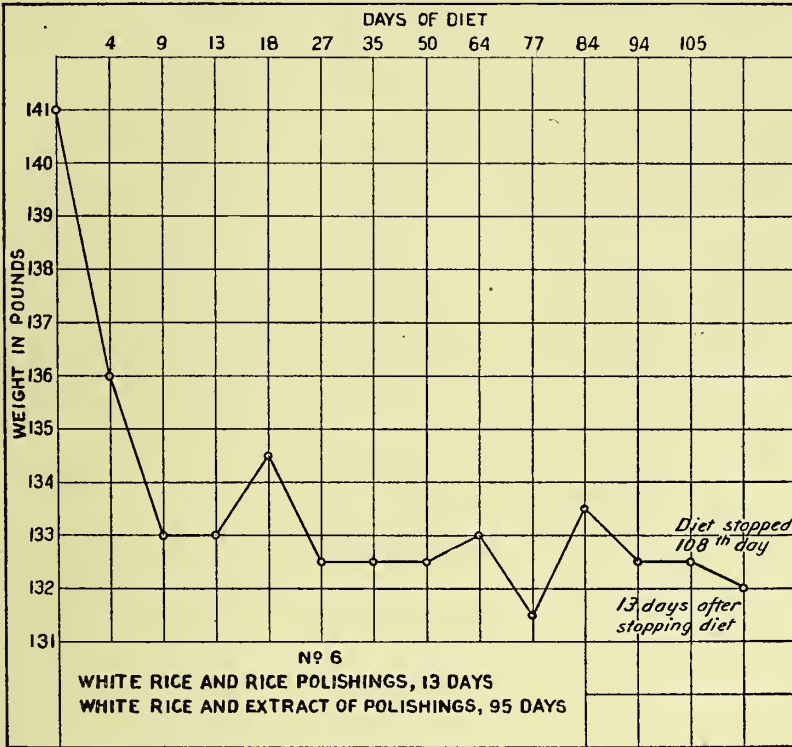


TABLE III.—Record of rations consumed by prisoners of Group I.^a

Prisoner number.	Kind of rice.	Duration of experiment.
4	White rice + rice polishings, 13 days; and white rice + extract of rice polishings, 84 days.	97 days, January 17 to April 22.
2		
1	White rice + rice polishings, 13 days; and white rice + extract of rice polishings, 95 days.	108 days, January 17 to May 3.
6		
5		
3		

^a Breakfast was uniform throughout the experiments and consisted of bread, about 100 grams; coffee, about 500 cubic centimeters; and sugar, about 15 grams. See Table I, page 293.

TABLE III.—Record of rations consumed by prisoners of Group I—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	4	2	1	6	5	3		4	2	1	6	5	3
<i>Day 1.</i>							<i>Day 8.</i>						
Rice	150	150	150	150	150	150	Rice	0	0	0	0	0	0
Bacon	50	50	50	50	50	50	Bacon	50	50	50	50	50	50
<i>Day 2.</i>							Rice	0	0	0	0	0	0
Onions.....	50	50	50	50	50	50	Onions.....	150	150	150	150	150	150
Lard.....	10	10	10	10	10	10	Lard.....	20	20	20	20	20	20
Rice	300	300	300	300	300	300	<i>Day 9.</i>						
Sugar	0	75	0	75	25	25	Bread.....	150	150	150	150	150	150
Bananas.....	150	150	150	150	150	150	Rice	0	0	0	0	0	0
<i>Day 3.</i>							Bacon	30	30	30	30	30	30
Bread	100	100	100	150	100	100	Rice	0	0	0	0	0	0
Rice	100	100	100	100	100	100	Sugar	0	0	0	0	0	0
Starch.....	0	0	0	15	0	25	Bananas.....	150	150	150	150	150	150
Sugar	0	0	0	10	0	15	<i>Day 10.</i>						
Lard.....	0	0	0	5	0	10	Rice	0	0	0	0	0	0
Rice	150	150	150	150	150	150	Bacon	50	50	50	50	50	50
Bacon	0	0	0	0	0	0	Bread.....	200	200	200	200	200	200
<i>Day 4.</i>							Rice	0	50	0	50	0	0
Rice	25	25	25	25	25	25	Starch.....	0	25	0	25	0	0
Onions.....	100	100	100	100	100	100	Sugar	0	10	0	10	0	0
Lard.....	15	15	15	15	15	15	Lard.....	0	5	0	5	0	0
Rice	25	25	25	25	25	25	<i>Day 11.</i>						
Sugar	75	75	75	75	75	75	Rice	0	0	0	0	0	0
Bananas.....	150	150	150	150	150	150	Onions.....	100	100	100	100	100	100
<i>Day 5.</i>							Lard.....	15	15	15	15	15	15
Bread	150	150	150	150	150	150	Rice	0	0	0	0	0	0
Rice	25	25	25	25	25	25	Bacon	50	50	50	50	50	50
Bacon	30	30	30	30	30	30	<i>Day 12.</i>						
Bread	200	200	200	200	200	200	Bread.....	150	150	150	150	150	150
Rice	50	50	50	50	50	50	Rice	0	0	0	0	0	0
Starch.....	50	50	50	50	50	50	Bacon	30	30	30	30	30	30
Sugar	25	25	25	25	25	25	Rice	0	0	0	0	0	0
Lard.....	20	20	20	20	20	20	Onions.....	150	150	150	150	150	150
<i>Day 6.</i>							Lard.....	20	20	20	20	20	20
Rice	0	0	0	0	0	0	<i>Day 13.</i>						
Onions.....	100	100	100	100	100	100	Bread.....	150	150	150	150	150	150
Lard.....	15	15	15	15	15	15	Rice	0	0	0	25	0	0
Rice	0	0	0	0	0	0	Starch.....	20	20	20	20	20	20
Bacon	50	50	50	50	50	50	Sugar	10	10	10	10	10	10
<i>Day 7.</i>							Lard.....	10	10	10	10	10	10
Rice	0	0	0	0	0	0	Rice	0	0	0	0	0	0
Bananas.....	100	100	100	100	100	100	Sugar	75	75	75	75	75	75
Sugar	0	0	0	0	0	0	Bananas.....	150	150	150	150	150	150
Bread	200	200	200	200	200	200	<i>Day 14.</i>						
Rice	0	0	0	0	0	0	Rice	300	300	300	300	300	300
Starch.....	0	0	0	0	0	0	Bacon	50	50	50	50	50	350
Sugar	0	0	0	0	0	0	Rice	350	350	350	350	250	50
Lard.....	0	0	0	0	0	0							

TABLE III.—Record of rations consumed by prisoners of Group I—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	4	2	1	6	5	3		4	2	1	6	5	3
<i>Day 14—Ctd.</i>							<i>Day 20—Ctd.</i>						
Onions	150	150	150	150	125	75	Rice	100	35	50	50	75	50
Lard	20	20	20	20	20	20	Starch	50	75	25	25	40	25
<i>Day 15.</i>							Sugar	25	10	10	10	10	10
Bread	150	75	150	150	150	75	Lard	20	10	10	10	10	10
Rice	100	50	100	100	100	50	<i>Day 21.</i>						
Starch	50	25	50	50	50	25	Rice	300	300	265	300	300	300
Sugar	25	10	25	25	25	10	Bananas	100	100	100	100	100	100
Lard	20	10	20	20	20	10	Sugar	15	15	25	25	25	25
Bread	150	75	100	100	100	150	Rice	300	300	300	300	300	300
Rice	200	200	200	200	200	200	Bacon	50	50	50	50	50	50
Bacon	50	50	50	50	50	50	<i>Day 22.</i>						
<i>Day 16.</i>							Rice	200	200	200	200	200	200
Rice	300	300	300	300	300	300	Bacon	30	30	30	30	30	30
Sugar	25	25	25	25	25	25	Bread	150	135	100	100	75	0
Bananas	100	100	100	100	100	100	Rice	350	350	350	350	350	350
Rice	350	350	350	350	350	350	Onions	150	150	150	150	150	150
Onions	150	150	150	150	150	150	Lard	20	20	20	20	20	20
Lard	20	20	20	20	20	20	<i>Day 23.</i>						
<i>Day 17.</i>							Rice	300	300	300	300	300	300
Bread	50	50	75	140	150	150	Bacon	50	50	50	50	50	50
Rice	200	200	100	65	0	0	Rice	300	300	300	300	300	300
Bacon	30	30	30	30	30	30	Sugar	75	75	75	75	75	75
Rice	300	300	300	300	300	300	Bananas	150	150	150	150	150	150
Sugar	40	40	40	40	40	40	<i>Day 24.</i>						
Bananas	150	150	150	150	150	150	Bread	150	150	150	150	150	150
<i>Day 18.</i>							Rice	0	30	0	30	0	0
Rice	300	300	300	300	225	300	Starch	0	15	0	15	0	0
Onions	100	100	100	100	100	100	Sugar	0	10	0	10	0	0
Lard	15	15	15	15	15	15	Lard	0	5	0	5	0	0
Bread	100	100	100	175	200	200	Rice	300	300	300	300	300	300
Rice	100	100	100	100	100	100	Bacon	50	50	50	50	50	50
Starch	25	25	0	25	0	0	<i>Day 25.</i>						
Sugar	10	10	0	10	0	0	Rice	200	200	200	200	200	200
Lard	10	10	0	10	0	0	Bread	150	0	100	75	135	150
<i>Day 19.</i>							Bacon	30	30	30	30	30	30
Rice	300	300	300	200	225	200	Dinner	No record kept.					
Bacon	50	50	50	50	50	50	<i>Day 26.</i>						
Rice	300	300	300	300	300	300	Rice	300	300	150	265	300	300
Sugar	65	40	50	75	75	75	Bananas	100	100	100	100	100	100
Bananas	150	150	150	150	150	150	Sugar	0	0	0	10	0	0
<i>Day 20.</i>							Rice	300	300	300	300	300	300
Rice	300	300	300	265	225	200	Bacon	50	50	50	50	50	50
Onions	100	100	100	100	100	100							
Lard	15	15	15	15	15	15							
Bread	65	150	135	150	200	200							

TABLE III.—Record of rations consumed by prisoners of Group I—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	4	2	1	6	5	3		4	2	1	6	5	3
<i>Day 27.</i>							<i>Day 33—Ctd.</i>						
Rice	300	300	300	300	300	265	Rice	No record kept.					
Onions	100	100	100	100	100	100	Onions						
Lard	15	15	15	15	15	15	Lard						
Bread	200	200	200	200	200	200	<i>Day 34.</i>						
Rice	30	30	30	30	30	30	Rice	200	200	200	200	100	0
Starch	20	20	20	20	20	20	Bread	150	25	75	100	150	150
Sugar	10	10	10	10	10	10	Bacon	30	30	30	30	30	30
Lard	5	5	5	5	5	5	Rice	300	300	100	300	300	150
<i>Day 28.</i>							Bananas	150	150	150	150	150	150
Rice	300	300	300	300	300	300	Sugar	0	0	0	0	0	0
Bacon	50	50	50	50	50	50	<i>Day 35.</i>						
Rice	0	0	100	75	0	75	Rice	200	300	300	270	270	270
Bananas	150	150	150	150	150	150	Bananas	100	100	100	100	100	100
Sugar	0	0	0	0	0	0	Sugar	10	0	0	0	0	0
<i>Day 29.</i>							Rice	350	350	350	350	350	350
Bread	150	150	150	150	150	150	Onions	150	150	150	150	150	150
Rice	0	0	0	0	0	0	Lard	20	20	20	20	20	20
Starch	0	0	0	0	0	0	<i>Day 36.</i>						
Sugar	25	25	25	25	25	25	Rice	300	300	300	300	300	300
Rice	350	115	175	305	350	175	Bacon	50	50	50	50	50	50
Onions	150	150	150	150	150	150	Rice	No record kept.					
Lard	20	20	10	20	20	20	Bananas						
<i>Day 30.</i>							Sugar						
Rice	200	200	200	175	200	200	<i>Day 37.</i>						
Bread	150	150	150	75	150	150	Rice	200	200	200	200	200	200
Bacon	30	30	30	30	30	30	Bread	150	50	110	110	150	150
Rice	300	300	300	265	300	150	Bacon	30	30	30	30	30	30
Bread	0	0	0	0	150	150	Rice	350	350	350	350	350	350
Bacon	50	50	50	50	50	50	Onions	150	150	150	150	150	150
<i>Day 31.</i>							Lard	20	20	20	20	20	20
Rice	300	300	200	300	300	265	<i>Day 38.</i>						
Bananas	150	150	150	150	150	150	Rice	300	300	200	300	100	100
Rice	300	300	300	225	300	300	Bananas	100	100	100	100	100	100
Onions	100	100	100	100	100	100	Rice	300	300	300	300	300	300
Lard	15	15	15	15	15	15	Bacon	50	50	50	50	50	50
<i>Day 32.</i>							<i>Day 39.</i>						
Rice	200	200	200	200	200	300	Rice	300	300	300	300	300	300
Bread	150	150	75	110	140	75	Bacon	50	50	50	50	50	50
Bacon	30	30	30	30	30	30	Rice	350	350	175	350	350	350
Rice	300	300	300	300	300	300	Onions	150	0	0	150	150	150
Bacon	50	50	50	50	50	50	Lard	20	0	0	20	20	20
<i>Day 33.</i>													
Rice	300	300	300	300	300	300							
Bacon	50	50	50	50	50	50							

TABLE III.—Record of rations consumed by prisoners of Group I—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	4	2	1	6	5	3		4	2	1	6	5	3
<i>Day 40.</i>							<i>Day 47—Ctd.</i>						
Rice	200	200	200	200	200	165	Rice	350	350	350	350	350	350
Bread	100	135	150	100	150	150	Onions	150	150	150	150	150	150
Bacon	30	30	30	30	30	30	Lard	20	20	20	20	20	20
Rice	0	300	225	300	300	100	<i>Day 48.</i>						
Bananas	150	150	150	150	150	150	Rice	0	265	265	240	300	0
Sugar	75	75	75	75	75	75	Bacon	50	50	50	50	50	50
<i>Day 41.</i>							Rice	0	270	100	100	300	0
Rice	300	300	300	240	300	300	Bananas	50	150	100	50	150	150
Bananas	100	100	100	100	100	100	<i>Day 49.</i>						
Rice	350	350	350	305	350	350	Rice	175	180	100	170	100	100
Onions	150	150	150	150	150	150	Bread	110	140	0	110	140	75
Lard	20	20	20	20	20	20	Bacon	30	30	30	30	30	30
<i>Day 42.</i>							Rice	350	350	350	350	350	350
Rice	300	300	300	300	300	300	Onions	150	150	150	150	150	150
Bacon	50	50	50	50	50	50	Lard	20	20	20	20	20	20
Rice	300	300	265	300	300	300	<i>Day 50.</i>						
Bananas	150	150	100	150	150	150	Rice	300	300	225	300	270	265
<i>Day 43.</i>							Onions	100	100	100	100	100	100
Rice	200	200	200	200	200	200	Lard	15	15	15	15	15	15
Bread	50	100	0	100	150	50	Rice	270	200	100	300	300	100
Bacon	30	30	30	30	30	30	Bananas	150	150	150	150	150	150
Rice	350	350	350	350	350	350	Sugar	75	75	75	75	75	75
Onions ^a	150	150	150	150	150	150	<i>Day 51.</i>						
<i>Day 44.</i>							Rice	0	240	0	0	60	0
Rice	300	300	300	300	300	300	Bananas	0	100	0	50	100	100
Onions	100	100	100	100	100	100	Sugar	25	25	25	25	25	25
Rice	300	300	300	300	300	300	Rice	0	0	0	0	300	0
Bananas	150	150	150	150	150	150	Bacon	50	50	50	50	50	50
<i>Day 45.</i>							<i>Day 52.</i>						
Rice	300	300	300	300	300	300	Rice	300	300	300	300	300	300
Bacon	50	50	50	50	50	50	Bacon	50	50	50	50	50	50
Rice	350	350	350	350	350	350	Rice	350	350	230	350	350	175
Onions	150	150	150	150	150	150	Onions	150	150	75	150	150	75
Lard	20	20	20	20	20	20	Lard	20	20	10	20	20	10
<i>Day 46.</i>							<i>Day 53.</i>						
Rice	200	200	200	200	200	100	Rice	200	200	200	200	200	200
Bread	0	25	0	25	50	0	Bread	0	75	75	150	50	75
Bacon	30	30	30	30	30	30	Bacon	30	30	30	30	30	30
Rice	300	300	150	300	300	300	Rice	0	0	0	0	0	0
Bananas	150	150	150	150	150	150	Bananas	150	150	150	150	150	150
Sugar	0	25	0	0	25	0	<i>Day 54.</i>						
<i>Day 47.</i>							Rice	0	0	0	0	100	0
Rice	150	265	150	300	300	240	Bananas	50	100	100	100	100	100
Bananas	100	100	100	100	100	100	Sugar	0	25	0	0	25	0

^a Raw onions with vinegar.

TABLE III.—Record of rations consumed by prisoners of Group I—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	4	2	1	6	5	3		4	2	1	6	5	3
<i>Day 54—Ctd.</i>							<i>Day 62.</i>						
Rice	0	0	0	0	175	115	Rice	300	300	300	300	300	300
Onions	150	150	0	150	150	0	Bacon	50	50	50	50	50	50
Lard	20	20	0	20	20	0	Rice	300	0	265	300	265	60
<i>Day 55.</i>							Bananas	150	150	150	150	100	50
Rice	225	300	240	300	225	240	<i>Day 63.</i>						
Bacon	50	50	50	50	50	50	Rice	200	200	200	200	200	200
Rice	300	300	0	300	300	300	Bread	0	0	0	0	100	0
Bananas	50	150	50	50	50	50	Bacon	30	30	30	30	30	30
<i>Day 56.</i>							Rice	350	350	350	350	350	350
Rice	200	0	175	165	200	200	Onions	150	0	0	150	150	150
Bread	0	0	75	110	150	150	Lard	20	0	0	20	20	20
Bacon	30	30	30	30	30	30	<i>Day 64.</i>						
Rice	350	350	350	350	350	350	Rice	300	300	265	300	300	300
Onions	50	20	150	150	0	150	Onions	0	0	0	0	0	0
Lard	10	5	20	20	0	20	Lard	0	0	0	0	0	0
<i>Day 57.</i>							Rice	300	300	300	300	300	300
Rice	300	300	300	300	300	300	Bananas	150	150	150	150	150	150
Onions	100	30	100	100	100	100	<i>Day 65.</i>						
Lard	15	5	15	15	15	15	Rice	300	300	265	300	300	300
Rice	300	300	300	300	300	300	Bananas	50	100	100	100	100	100
Bananas	150	150	150	150	150	150	Sugar	0	25	0	25	0	0
<i>Day 58.</i>							Rice	300	300	300	300	300	300
Rice	75	0	150	100	150	0	Bacon	50	50	50	50	50	50
Bananas	50	100	0	100	100	100	<i>Day 66.</i>						
Rice	300	240	300	300	300	300	Rice	300	300	240	300	300	300
Bacon	50	50	50	50	50	50	Onions	100	100	100	100	100	100
<i>Day 59.</i>							Lard	15	15	15	15	15	15
Rice	300	300	300	300	300	300	Rice	300	75	150	300	150	200
Bacon	50	50	50	50	50	50	Bananas	150	150	150	150	150	150
Rice	350	350	350	350	350	350	Sugar	75	0	0	50	0	0
Onions	75	75	75	75	75	75	<i>Day 67.</i>						
Lard	10	10	10	10	10	10	Rice	200	200	200	200	200	200
<i>Day 60.</i>							Bread	150	0	0	75	150	75
Rice	300	300	300	300	75	0	Bacon	30	30	30	30	30	30
Bread	0	0	0	0	150	150	Rice	350	230	350	350	350	175
Bacon	30	30	30	30	20	30	Onions	150	0	0	150	150	75
Rice	300	300	300	300	300	300	Lard	20	0	0	20	20	10
Bananas	150	150	150	150	150	150	<i>Day 68.</i>						
<i>Day 61.</i>							Rice	300	300	30	300	300	300
Rice	300	270	150	275	265	225	Bananas	150	150	150	150	150	150
Bananas	100	100	100	100	100	100	Sugar	t ^a	t	0	0	t	0
Sugar	25	0	0	0	25	0	Rice	350	0	0	350	350	350
Rice	350	115	115	350	350	265	Onions	150	150	150	150	150	150
Onions	150	0	150	150	150	150	Lard	20	20	20	20	20	20
Lard	20	0	20	20	20	20							

^a Very small amount.

TABLE III.—Record of rations consumed by prisoners of Group I—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	4	2	1	6	5	3		4	2	1	6	5	3
<i>Day 69.</i>							<i>Day 76.</i>						
Rice	300	300	300	265	300	300	Rice	300	265	150	265	150	200
Bacon	50	50	50	50	50	50	Onions	100	0	30	100	100	100
Rice	300	0	150	75	300	240	Lard	15	0	5	15	15	15
Bananas	150	150	150	150	150	150	Rice	300	200	100	300	270	75
Sugar	75	75	75	75	75	75	Bacon	50	50	50	50	50	50
<i>Day 70.</i>							<i>Day 77.</i>						
Rice	300	300	300	300	300	300	Rice	0	0	0	0	150	150
Onions	100	100	100	100	100	100	Bananas	50	100	50	100	100	100
Lard	15	15	15	15	15	15	Sugar	25	0	10	20	0	0
Rice	300	300	150	300	240	200	Rice	300	0	0	300	300	150
Bacon	50	50	50	50	50	50	Bacon	50	50	50	50	50	50
<i>Day 71.</i>							<i>Day 78.</i>						
Rice	200	200	200	200	200	200	Rice	200	200	200	200	200	200
Bread	0	0	0	0	0	0	Bread	0	0	0	0	0	0
Bacon	30	30	30	30	30	30	Bacon	30	30	30	30	30	30
Rice	30	30	30	30	150	30	Rice	350	350	305	350	350	350
Bananas	150	150	150	150	150	150	Onions	t	t	t	t	150	150
Sugar	75	75	75	75	75	75	Lard	t	t	t	t	20	20
<i>Day 72.</i>							<i>Day 79.</i>						
Rice	300	265	300	300	300	300	Rice	300	300	300	300	300	300
Bacon	50	50	50	50	50	50	Bacon	50	50	50	50	50	50
Rice	305	350	115	350	225	265	Rice	0	0	0	0	0	0
Onions	50	50	20	0	150	50	Bananas	150	t	0	t	0	150
Lard	10	10	5	0	20	10	Sugar	75	t	0	t	0	75
<i>Day 73.</i>							<i>Day 80.</i>						
Rice							Rice	300	0	0	300	265	300
Bananas							Onions	100	0	0	0	50	0
Sugar							Lard	15	0	0	0	10	0
Rice	No record kept.						Rice	300	300	300	300	300	300
Onions							Bacon	50	50	50	50	50	50
Lard							<i>Day 81.</i>						
<i>Day 74.</i>							Rice	300	300	300	200	300	225
Rice	200	200	200	200	200	200	Bananas	120	120	50	50	120	100
Bread	0	0	0	0	0	0	Sugar	10	10	10	25	25	25
Bacon	30	30	30	30	30	30	Rice	90	90	35	35	350	Sick
Rice	300	150	0	300	240	200	Onions	40	120	0	20	0	Sick
Bananas	150	150	150	150	150	150	Lard	5	15	0	5	0	Sick
Sugar	75	0	0	75	75	40	<i>Day 82.</i>						
<i>Day 75.</i>							Rice	200	160	50	200	200	200
Rice	0	0	0	0	0	0	Bread	0	0	120	0	120	0
Bananas	100	100	100	100	100	100	Bacon	30	30	30	30	30	30
Sugar	10	0	0	0	0	10	Rice	265	40	40	265	40	40
Rice	300	300	300	300	300	300	Bacon	50	50	0	50	50	0
Bacon	50	50	50	50	50	50							

TABLE III.—Record of rations consumed by prisoners of Group I—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	4	2	1	6	5	3		4	2	1	6	5	3
<i>Day 83.</i>							<i>Day 90—Ctd.</i>						
Rice	300	40	0	150	300	100	Bacon	30	30	30	30	30	30
Onions	100	0	0	50	100	0	Rice	300	t	40	225	225	200
Lard	15	0	0	10	15	0	Bacon	50	50	50	50	50	50
Rice	75	40	0	225	200	150	<i>Day 91.</i>						
Bananas	150	150	150	150	150	150	Rice	300	150	150	300	300	300
<i>Day 84.</i>							Onions	0	50	100	0	100	50
Rice	300	200	300	300	300	240	Lard	0	10	15	0	15	10
Bacon	50	50	50	50	50	50	Rice	0	0	0	240	150	0
Rice	115	230	t	230	175	175	Bananas	0	100	50	0	100	50
Onions	150	75	0	40	40	75	Sugar	0	t	t	0	0	t
Lard	20	10	0	5	5	10	<i>Day 92.</i>						
<i>Day 85.</i>							Rice	300	225	150	300	300	300
Rice	300	270	265	300	300	150	Bacon	50	50	50	50	50	50
Bananas	100	100	100	100	100	100	Rice	350	175	t	225	225	225
Sugar	t	t	0	0	0	0	Onions	0	20	0	20	150	20
Rice	150	265	150	300	265	225	Lard	0	5	0	5	20	5
Bacon	50	50	50	50	50	50	<i>Day 93.</i>						
<i>Day 86.</i>							Rice	300	300	300	300	300	300
Rice	200	200	150	200	200	200	Bananas	100	100	100	100	100	100
Bread	0	0	0	0	0	0	Sugar	25	25	25	25	25	25
Bacon	30	30	30	30	30	30	Rice	300	200	75	300	300	300
Rice	350	280	0	265	90	90	Bacon	50	50	50	50	50	50
Onions	75	75	0	75	0	0	<i>Day 94.</i>						
Lard	10	10	0	10	0	0	Rice	0	0	0	0	35	0
<i>Day 87.</i>							Bread	150	150	0	75	150	150
Rice	300	150	75	300	300	300	Bacon	30	15	30	30	30	30
Bacon	50	50	25	50	50	50	Rice	350	350	(?)	350	350	350
Rice	0	0	40	40	80	40	Onions	0	0	(?)	0	150	150
Bananas	150	150	150	150	150	150	Lard	0	0	(?)	0	20	20
Sugar	75	0	10	75	25	30	<i>Day 95.</i>						
<i>Day 88.</i>							Rice	300	300	(?)	300	300	240
Rice	300	300	60	300	150	300	Bacon	0	0	(?)	0	0	0
Onions	25	50	0	0	0	50	Rice	240	300	(?)	300	225	265
Lard	5	10	0	0	0	10	Bananas	150	150	(?)	150	150	150
Rice	300	40	225	300	300	270	Sugar	75	20	(?)	0	0	30
Bacon	50	50	50	50	50	50	<i>Day 96.</i>						
<i>Day 89.</i>							Rice	300	300	(?)	240	200	225
Rice	300	300	0	150	200	150	Onions	0	0	(?)	0	0	0
Bananas	0	100	50	0	100	100	Rice	225	240	(?)	150	225	150
Sugar	0	0	0	25	10	10	Bacon	50	50	(?)	50	50	50
Rice	35	0	0	t	175	120	<i>Day 97.</i>						
Onions	0	0	0	0	0	0	Rice	0	0	(?)	0	0	0
<i>Day 90.</i>							Bananas	100	50	(?)	100	100	0
Rice	200	160	135	200	200	200	Sugar	0	0	(?)	0	0	0
Bread	0	0	0	0	0	0	Rice	300	300	150	300	225	300
							Fish	30	30	30	30	30	30

TABLE III.—Record of rations consumed by prisoners of Group I—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	4	2	1	6	5	3		4	2	1	6	5	3
Day 98.							Day 103—Ctd.						
Rice	(a)	0	150	250	265	250	Fish	30	30	30	30	30	
Fish		30	30	30	30	30	Starch	10	10	10	10	10	
Rice		300	200	300	300	225	Lard	15	15	15	15	15	
Potatoes		100	150	150	150	150	Rice	40	40	225	225	150	
Bacon		50	25	50	50	50	Bacon	50	50	50	50	50	
Day 99.							Day 104.						
Rice		200	200	150	t	0	Rice	200	265	300	200	200	
Potatoes		75	75	150	150	0	Potatoes	100	100	100	50	100	
Bacon		15	15	30	30	0	Bacon	30	30	30	15	30	
Rice		300	240	300	240	250	Rice	300	225	265	300	150	
Fish		30	30	30	30	30	Bananas	150	150	150	150	150	
Day 100.							Day 105.						
Rice		265	240	300	300	150	Rice	240	265	250	300	300	
Bananas		100	100	100	100	100	Fish	30	30	30	30	15	
Rice		50	75	0	175	135	Rice	225	100	150	265	265	
Bread		75	150	150	150	0	Potatoes	100	100	100	50	100	
Bacon		30	30	30	30	30	Bacon	30	30	30	15	30	
Day 101.							Day 106.						
Rice		300	300	300	300	300	Rice	300	300	265	240	240	
Fish		25	25	25	25	25	Potatoes	100	100	100	100	100	
Potatoes		100	100	100	100	100	Fish	30	30	30	30	30	
Rice		350	175	350	350	265	Rice	100	100	100	300	75	
Onions		0	0	0	0	0	Bananas	150	50	150	150	150	
Day 102.							Sugar	0	75	0	75	0	
Rice		300	300	300	300	300	Day 107.						
Fish		40	40	40	40	40	Rice	225	200	100	225	150	
Rice		225	225	265	300	300	Bacon	50	50	0	50	50	
Potatoes		100	100	100	100	0	Rice						
Bacon		30	30	30	30	0	Potatoes	No record kept.					
Day 103.							Fish						
Rice		300	300	300	300	150	Day 108.						
Potatoes		100	100	100	100	100	End of experiment.						

a Diet discontinued.

GROUP II.

CASE NO. 7 (GROUP II).

Diet: White rice for 97 days followed by red rice for 20 days, together with the special diet common to all the groups. } Total period of experiment, 117 days.

Dried codfish and potatoes were added to the diet on the 97th day.

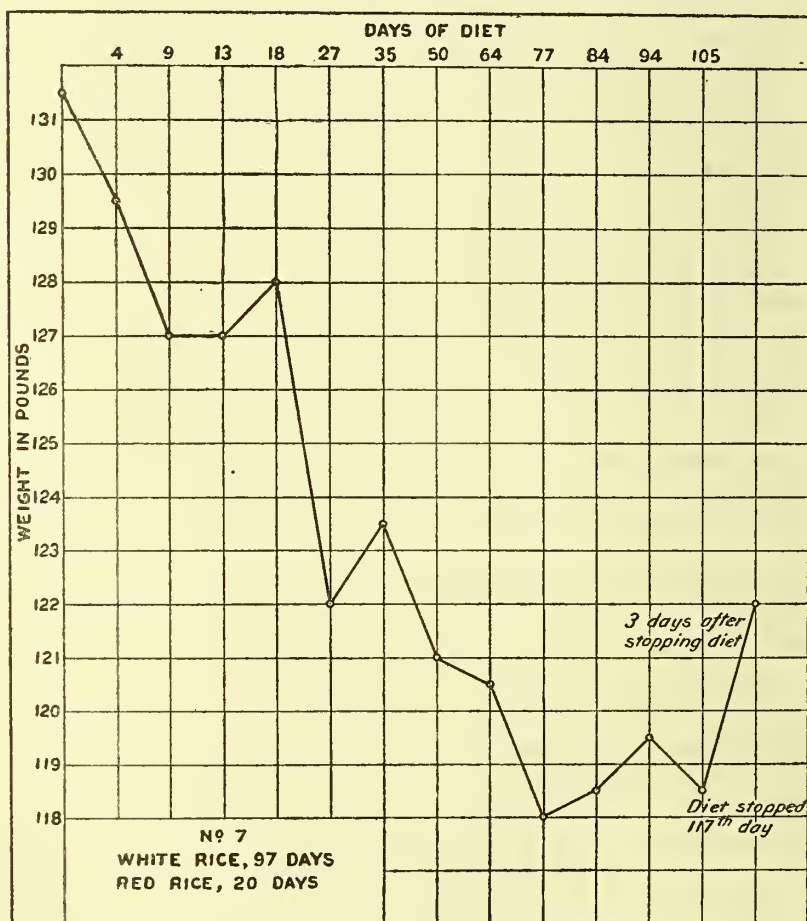
Following is a summary of the notes of the case: Fairly well-nourished man; has been wearing iron prison shackles on his

legs for several months; his knee jerks are absent; states that he has never had beriberi; age about 35 years; the examination of the lungs shows on percussion, anteriorly, general diminished resonance on both sides, more marked on the right side; no special areas of dulness; the respiratory sounds are slightly enfeebled over the right upper lobe of the lung anteriorly; evidently there is an old thickening of the pleura; on auscultation no râles are heard; there is no tubular modification of the breath sounds. The examination of the heart shows no increase in the area of dulness; the point of maximum impulse is not visible; very indistinctly palpable, 7.5 centimeters to the left of the median line and 2.8 centimeters below the nipple line; on auscultation, the first sound at the apex is slightly prolonged, but there is no distinct murmur; neither second sound is accentuated; there is no epigastric pulsation; the pulse is 96, and the systolic blood pressure 102 millimeters Hg; the liver flatness extends from the lower border of the fifth rib; the liver is not palpable below the costal margin; the spleen is not palpable.

Although he ate fairly well at first, he lost rapidly in weight, and after one month weighed 4.5 kilograms (10 pounds) less than when the experiment was begun. On the thirtieth day of the diet, the note made was as follows: Tongue swollen and reddened; slight erosions on the corners of the mouth; hordeolum on left lower eyelid; pulse 104, rather weak; temperature 99, respirations 18; complains of sore throat, and the voice is hoarse; there is no tenderness of the calf muscles, and no œdema of the legs; there is impaired sensation to touch and pain over the skin about the ankles. On the thirty-fourth day the following note was made. Complains of sore mouth and throat; gastric pain and soreness of the calves of the legs; the pain in the calves of the legs has persisted for two days. He is somewhat constipated. A mouth wash of tincture of myrrh and of boric acid, for hourly use, and fluid extract of cascara sagrada, for nightly use, were prescribed. The sores on the corners of the mouth and on the lips were touched with a solution of silver nitrate. The patient grew gradually weaker. A marked catarrhal conjunctivitis developed, which was treated locally. On the fifty-fourth day he was taken to the prison hospital with a temperature of 38°.6. The same diet was taken to him at the hospital, and he was not supposed to eat anything else, but we can not be absolutely sure that during the time which he spent in the hospital he did not sometimes eat other food. It seemed possible that his slight rise of temperature which continued for about two and

one-half days might have been due to old pulmonary trouble. However, there were no râles present in the lungs, and the sputum was negative for tubercle bacilli. On the fifty-seventh day he returned from the prison hospital. However, he continued to lose in weight. On the seventy-fourth day he was found lying in bed, complaining of weakness and of soreness "all over the body," and of a sense of tightness about the neck. He stated that when he moved his hands and legs they seemed stiff. He ate nothing at noon. The pulse was 130; the interval between the heart sounds was evenly spaced (pendulum spacing). There was no accentuation or reduplication of the second sounds at the base, and no murmurs were present. There was visible pulsation of the vessels of the neck. The point of maximum impulse was not distinctly visible nor palpable. The respirations were increased in number. At 4 p. m. he still would not eat. The pulse was slower and occasionally missed a beat. On the seventy-fifth day the following note was made: The pulse is 110; the heart sounds have the same equal spacing. On the seventy-seventh day, the patient feels much better, is up, and eating. Seventy-eighth day: Continues to feel much better, no change in heart sounds. Continues to lose in weight. Eighty-first day: He has recovered from all subjective symptoms and states that he feels well. On the eighty-fifth day the systolic blood pressure was 90 millimeters Hg. On the eighty-eighth day the note was made as follows: 12 m. in bed again; pulse 104; respirations 40; complains of feeling hot, and of tingling and pains in the fingers and toes, and of headache; 4 p. m. pulse 96, respirations 24; complains of pain all over the body, and will not eat. Eighty-ninth day, condition of patient much the same. Ninetieth day, pulse 100. Complains of headache, weakness, no appetite, and pains from the knees to the toes and from the elbows to the fingers. No areas of distinct anæsthesia found. During the whole time of the experiment the knee jerks were absent. On the ninety-first day the note was made that a severe catarrhal conjunctivitis had developed for which treatment was given. Pulse 100, respirations 18. Marked pain in the fingers and toes. Ninety-fifth day, has been in bed two days, complaining of pains throughout the body; pulse 120. There is no distinct increase in the area of cardiac dulness. The heart sounds are evenly spaced. Owing to the complaints of this prisoner, it became necessary to change his diet, and on the ninety-seventh day red rice was substituted for white rice, and dried codfish and potatoes were added to the diet. On the ninety-ninth day the note was made: There is no throbbing over

the cardiac area; the heart sounds are rapid and evenly spaced; no murmur; he complains of no pain. On the one hundred fifth day his condition was much the same. On the one hundred seventeenth day the diet was discontinued. On the one hundred nineteenth day the following note was made: Patient still complains of pains in his fingers and toes; there is no tenderness in the calves of the legs, but he complains of some pain in the chest; apparently nothing in the lungs to account for this pain; pulse 100; no præcordial nor epigastric pulsation; point of maximum impulse invisible; both heart sounds are clear at the apex and base; area of cardiac dulness not increased; there is no oedema of the legs; the knee jerks have been absent throughout the course of the experiment; the examination of the urine shows



no albumin and no casts. He says he feels better than he did before the last change was made in his diet, but weaker than he did before he began the experiment. He had lost 6.1 kilograms (13.5 pounds) during the time he was on the diet. Although this patient had some of the important symptoms of beriberi, a definite diagnosis of the disease was not made. Three days after the change to the regular prison ration he had gained 1.5 kilograms (3.5 pounds).

CASE NO. 8 (GROUP II).

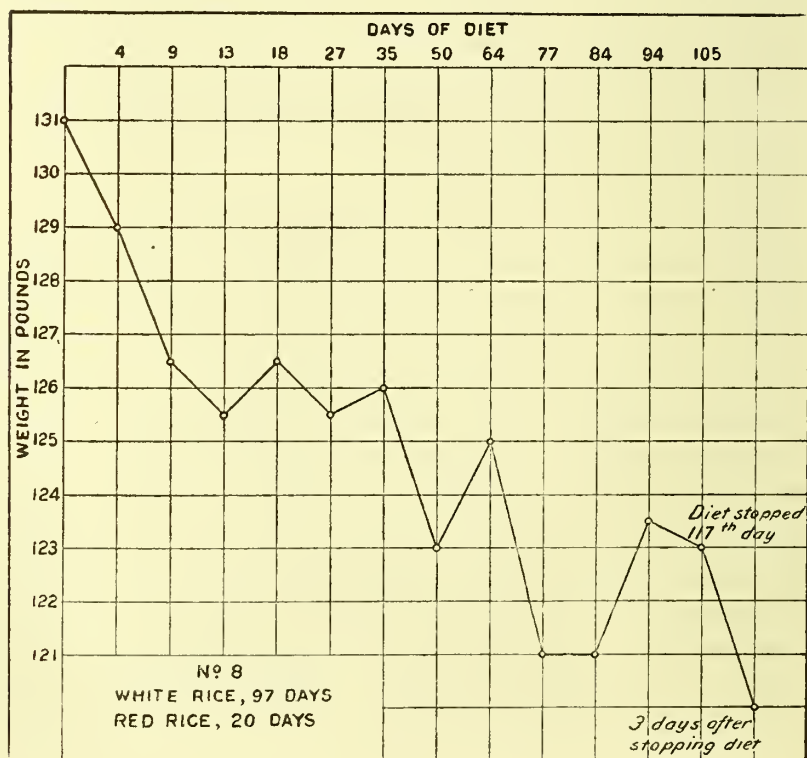
Diet: White rice 97 days followed by red rice 20 days, together with the special diet common to all the groups.	}	Total period of experiment, 117 days.
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Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: Percussion of lungs shows no dulness; on auscultation, respiratory sounds slightly roughened at apices and somewhat enfeebled; no tubular modification of the sounds and no râles are present; posteriorly the respiratory sounds are normal; examination of the heart shows no increase in the area of dulness beyond the normal; the point of maximum impulse is invisible; it is palpable 7.5 centimeters to the left of the median line and 2 centimeters below the nipple line; the heart sounds are clear at the apex and base; there is no epigastric pulsation; the pulse is 88, and the systolic blood pressure 110 millimeters Hg; the spleen and liver are not enlarged; the knee jerks are active.

The notes of this case up to the sixty-fourth day are unimportant except that he had lost 2.7 kilograms (6 pounds) in weight. On this day there was slight bilateral prætibial pitting. There was no complaint of pain. On the seventy-first day the note was made: Point of maximum impulse invisible and not distinctly palpable; no heaving of chest wall; pulse slow and regular; heart sounds normal and normally spaced; œdema of legs distinct; knee jerks active. On the seventy-fourth day he complained of weakness and pains throughout the body. He remained in bed and ate no dinner or supper. The pulse was 88. On the seventy-seventh day the pulse was 80. He had been feeling better since the last note was made. On the seventy-eighth day he complained of pain and tenderness over the region of the right shoulder. On the eighty-first day the pain was better. The knee jerks were still active. On the eighty-fourth day the knee jerks were active. The œdema of the legs continued, and the calves were tender on pressure. On the following day the

systolic blood pressure was 85 millimeters Hg. On the ninetieth day the note was made as follows: He has constantly complained of pain all over the body and is perceptibly weaker; the legs are markedly œdematous; the knee jerks are present but weak; there is slight pulsation visible over the cardiac area; no murmurs are present; the second sounds are not accentuated; there is no distinct change in the cardiac dulness. On the ninety-fifth day the knee jerks could not be elicited; the pulse was 104; otherwise his condition had changed little since the last note. Red, unpolished rice was substituted on the ninety-seventh day for the white polished rice, and dried codfish and potatoes were added to the diet. It was necessary to make these changes, on account of the complaints of the prisoner. On the ninety-ninth day the pulse was 100. There was pulsation over the cardiac area. The first sound was prolonged at the apex, but there was no distinct murmur. The point of maximum impulse was 9 centimeters to the left of the median line, but there was no distinct increase in the area of cardiac dulness beyond the normal limits. There was marked œdema and tenderness of the calves



of the legs. The knee jerks were absent. On the following day the pulse was 92, and on the one hundred fourth day it was 76. The patient's condition did not change much during the next two weeks. During this time he had not gained in weight. On the one hundred seventeenth day the diet was discontinued, and he was placed upon the regular prison ration. Two days later the following note was made: Pulse 88; no epigastric pulsation; the point of maximum impulse is invisible; it is palpable 9.25 centimeters to the left of the median line; the first sound of the heart is prolonged at the apex; there is no distinct murmur; the cardiac dulness extends 2 centimeters to the left of the nipple line and to the right not beyond the edge of the sternum; the nutrition is fair; there is still marked pain and tenderness in the calves of the legs; the œdema of the legs has disappeared; the knee jerks are absent; the examination of the urine showed no albumin and no casts; he states that he feels somewhat stronger since the change in diet. Three days after his return to the regular prison ration he had lost 1.3 kilograms (3 pounds). He gradually recovered. This man evidently suffered from beriberi.

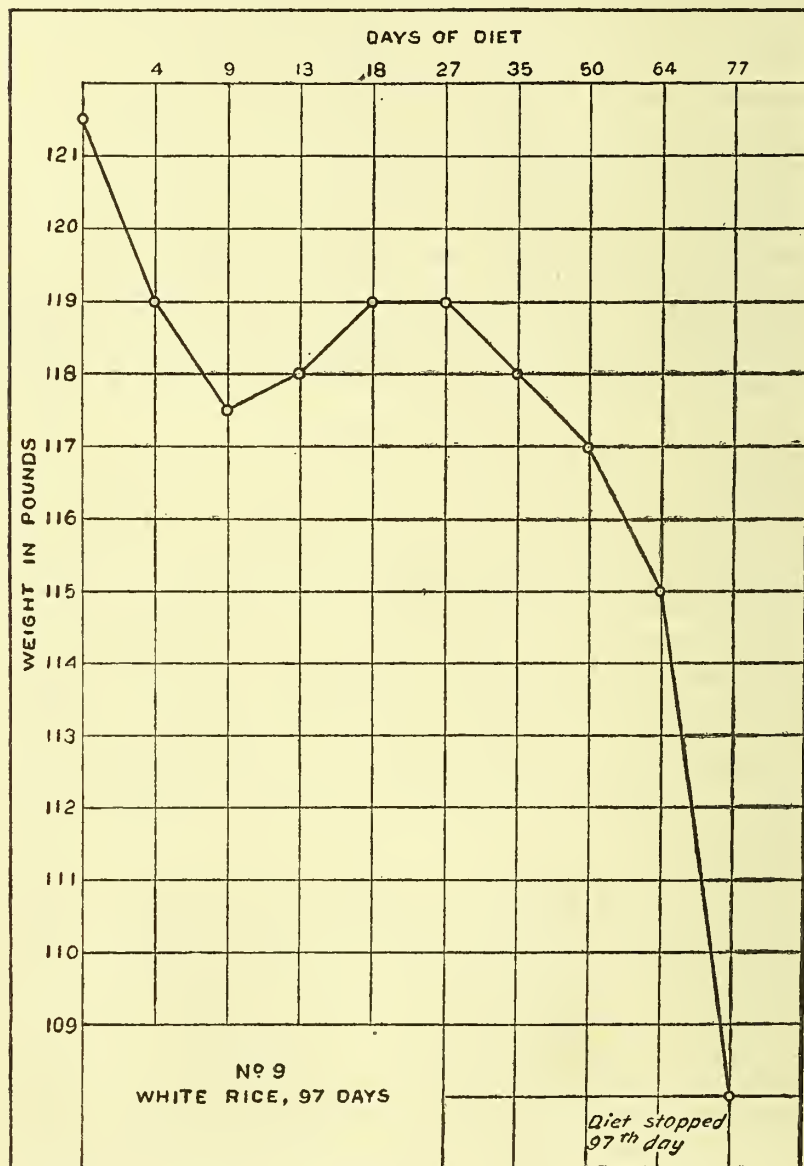
CASE NO. 9 (GROUP II).

Diet: White rice 97 days, together with the special diet common to all the groups.

Following is a summary of the notes of the case: Fairly well-nourished individual; percussion of the lungs shows no dulness; on auscultation the respiratory sounds are normal; examination of the heart shows no increase in the area of cardiac dulness beyond the normal; the point of maximum impulse is invisible; it is palpable 6.5 centimeters to the left of the median line and 3 centimeters below the nipple line; the heart sounds are clear at the apex and base; there is no visible epigastric pulsation; the pulse is 86, and the systolic blood pressure 100 millimeters Hg (Faught); the liver and spleen are not enlarged; the knee jerks are active.

The notes of this case are unimportant up to the thirty-fifth day, when erosions about the corners of the lips appeared. These were touched with a solution of silver nitrate. On the fifty-third day the note was made that for some days he has complained of soreness of the skin over the epigastrium, and has lost 2.2 kilograms (5 pounds) in weight since the beginning of the experiment. By the seventy-fourth day he had lost 9.5 kilograms (21 pounds). The note on this day reads: He has been complaining for some days of pain in the abdomen and chest and seems

much weaker; the pulse is normal; he remained in bed and ate no dinner nor supper. On the seventy-ninth day he was in bed, complaining of epigastric pain; pulse 80, rather weak. On the eightieth day the knee jerks were still present, but were weak; pulse 84 before and 96 after slight exertion; epigastric pulsation was visible; the respirations were 60 and very shallow; the first heart



sound was prolonged, but there was no distinct murmur; the second sounds were not accentuated nor reduplicated at the base. On the eighty-first day he was taken to the prison hospital on account of the persistent dyspnoea. Here he was given the same diet, and was isolated in a locked room. However, it is possible that he may have received some other food during the time he was in the hospital. On the eighty-fourth day the pulse was 100 and the respirations 40; the heart sounds were clear; the first sound was prolonged; there was no cardiac pulsation visible and no distinct increase in the area of dulness to the right or left; the knee jerks were doubtful; the legs were held rigidly. On the eighty-fifth day he stated his fingers felt as though they were made of rubber. There was slight anæsthesia over the finger tips. The systolic blood pressure was 85 millimeters Hg. On the eighty-eighth day the note states: Pulse 72; no epigastric nor cardiac throbbing; no marked tenderness of calves of the legs. On the eighty-ninth day, general condition very much the same; the knee jerks are absent. On the ninetieth day the pulse was 88; the patient complained of pain in the legs and chest; he was very weak, but could walk; his gait showed evidence of muscular weakness, but was not typically ataxic; there was hyperæsthesia of the muscles of the legs, and there was slight œdema over the tibiæ; there was no epigastric nor præcordial pulsation. The knee jerks were absent. On the ninety-first to the ninety-seventh days the jerks were always absent. The condition of the patient remained about the same, except that he grew weaker. On the ninety-seventh day there was slight œdema over the tibiæ. The diet was then discontinued. This man evidently suffered from beriberi. The urine was examined daily for the last three weeks of the experiment. It was always greatly decreased in amount but contained no albumin nor casts.

CASE NO. 10 (GROUP II).

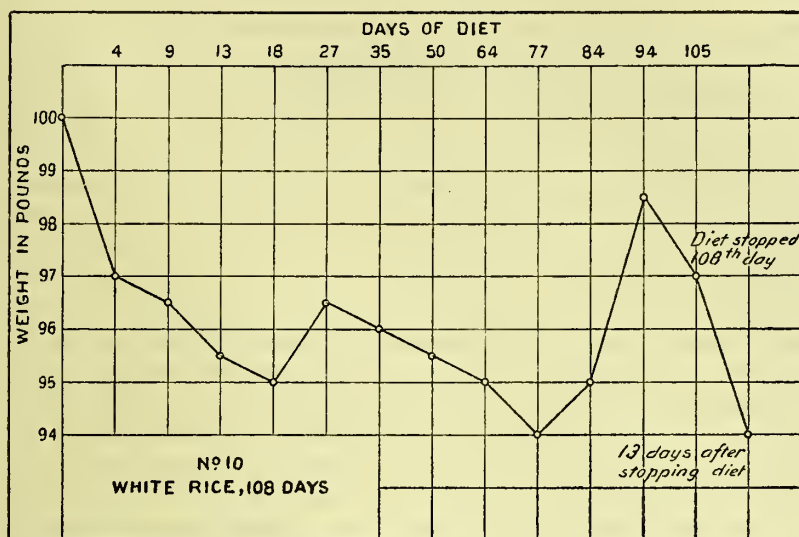
Diet: White rice 108 days, together with the special diet common to all the groups.

Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: Sparely nourished man of small stature; percussion and auscultation of the lungs normal; examination of the heart shows no increase of the area of dulness beyond the normal; the point of maximum impulse is invisible; it is palpable 6.25 centimeters to the left of the median line and 3 centimeters below the nipple line; the heart sounds are clear at the apex and base; there is no epigastric pulsation; the pulse is 84, and the systolic blood pressure 124 milli-

meters Hg (Faught); the liver and spleen are not enlarged; the knee jerks are active.

The patient at first lost 2.2 kilograms (5 pounds) in weight. The notes up to the seventy-fourth day of the diet are otherwise unimportant. On the seventy-fourth day he complained of headache and weakness. The pulse was 100. He ate no dinner nor supper. On the eighty-first day the knee jerks were still active. The patient seemed better and did not complain. On the eighty-fifth day the systolic blood pressure was 92 millimeters Hg. On the ninetieth day the knee jerks were weak; the patient stated that he felt well. On the ninety-fifth day the knee jerks were weak; there were no apparent changes in the condition of the heart. Owing to the complaints of this prisoner, on the ninety-seventh day dried codfish and potatoes were added to the diet. On the ninety-ninth day the following note was made: Point of maximum impulse 7.5 centimeters to the left of the median line and 3 centimeters below the nipple line; pulse 84; at the apex the first sound is accentuated; there is a tendency to pendulum spacing between the beats, while there is diffuse throbbing over the cardiac area, extending from the sternum to the nipple; there is slight visible epigastric pulsation and moderate œdema of the legs; there is pain and tenderness of the calves; no hyperæsthesia of the skin; the knee jerks are very weak. One hundred fifth day: Complains of pain in chest and legs; calves tender on pressure, and he walks with a slight limp; pulse 96; there is no œdema of the legs; the knee jerks are not elicited. On the one hundred sixth day the knee jerks could not be elicited. There was no œdema of the legs. The tenderness of the calves continued. On the one hundred eighth day it became necessary to discontinue the diet. The following note was then made: Sparely nourished individual; pulse 88; pulsation over cardiac area seems a little less marked than at the time of the last note, but is easily palpable over the whole cardiac area; slight epigastric pulsation; first sound at beginning much roughened and prolonged; pendulum spacing between the heart sounds has disappeared; the sounds are clear at the base; the point of maximum impulse is 9 centimeters to the left of the median line; the dulness extends to the left 2 centimeters outside the nipple line and to the right just beyond the edge of the sternum; there is slight œdema of the legs and hyperæsthesia of the calf muscles; the knee jerks are absent. Thirteen days after his return to the regular prison ration he had lost 4 pounds more. This man evidently suffered from beriberi.



CASE NO. 11 (GROUP II).

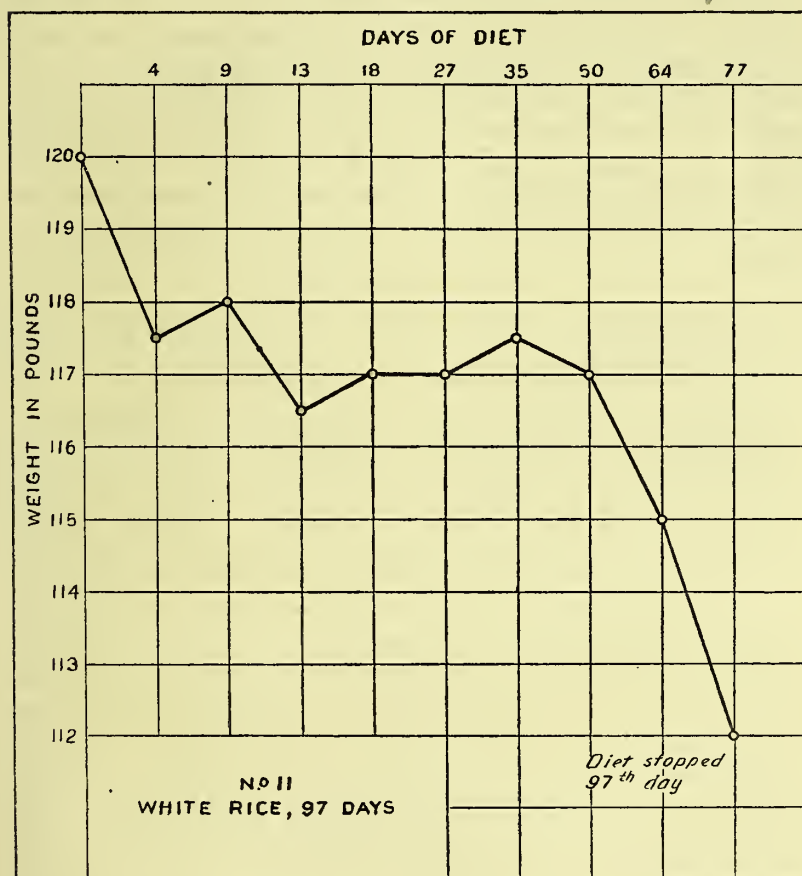
Diet: White rice 97 days, together with the special diet common to all the groups.

Following is a summary of the notes of the case: Fairly well-nourished man; auscultation and percussion of the lungs shows nothing abnormal; examination of the heart shows no increase in the area of cardiac dulness beyond the normal; the point of maximum impulse is not visible; it is palpable 8 centimeters to the left of the median line and 2 centimeters below the nipple line; there is no epigastric pulsation; the heart sounds are clear; the pulse is 80, and the systolic blood pressure 110 millimeters Hg (Faught); the liver dulness extends from the lower border of the fourth rib to the costal margin; the spleen is not palpable; the knee jerks are very active.

The patient lost but 1.3 kilograms (3 pounds) in weight up to the fiftieth day of the diet. On the thirty-fifth day erosions appeared on the corners of the lips. These were touched with a solution of silver nitrate. The notes are otherwise unimportant up to the forty-ninth day, when œdema of the right leg above the ankle was noted. The knee jerks were normal or increased. By the fiftieth day the œdema of the ankle had subsided. On the fifty-third day he complained of soreness of the left eye and of headache. On the sixty-fourth day at noon he vomited. He complained of no pain, and there was no fever. His food was left with him. On the sixty-fifth day he felt better and was eating

again. On the sixty-sixth day he complained of feeling cold; pulse 84; no fever and no pain. There was a slight cough, but apparently no disturbance of the lungs; the right knee jerk seemed more active than the left. His food was left with him as he did not care to eat. On the sixty-seventh day he ate bread and bacon, but no rice for dinner; however, he ate rice for supper. On the seventieth day he complained of general pain throughout the body. His pulse was 84. The first sound of the heart was distinctly prolonged, suggesting a very soft systolic murmur. The knee jerks were not obtained. On the seventy-first day the note states: Point of maximum impulse not distinctly visible; impulse of heart near apex visible between respirations; point of maximum impulse on palpation somewhat diffuse and may be felt as far out as the nipple line; slight visible pulsation in the vessels of the neck; the first heart sound is somewhat prolonged at the apex; there is no distinct murmur; the second sounds are not markedly accentuated; there is no abnormal spacing between the heart sounds. The cardiac dulness extends to the left, 3 centimeters outside of the nipple line; it is not increased to the right of the sternum; the pulse is 88 before and 94 after slight exertion; he complains of soreness over the chest and abdomen, and says that at night the skin feels as though being stretched. He also complains of soreness in the calves of the legs and pain on pressure over the calves of the legs. He winces slightly on pressure in this region. He says he has a sensation as if winds were blowing over the pores of the skin, especially over those of the chest and abdomen. There is apparently no marked loss of tactile or pain sense. The right knee jerk can not be elicited; the left jerk is very weak. On the seventy-fourth day the note reads: The patient has lost 3.6 kilograms (8 pounds) since the beginning of the experiment. He is in bed, and complains of pain over the abdomen, chest, and legs. The calves are tender on pressure. He states that he feels feverish. The pulse is 100. There is no rise in temperature. He ate no dinner nor supper. On the seventy-fifth day the note reads: Pulse 100; point of maximum impulse easily visible, rather diffuse; can be seen and felt as far out as the nipple line; no change in the heart sounds since the seventy-first day; heaving over heart more marked; knee jerks can not be elicited. On the seventy-seventh day the note states that he vomited his dinner. He is very weak; there is marked lameness and dyspnoea; the respirations are 40, and pulse 88. On the seventy-eighth day the note reads: Up at breakfast, in bed at dinner time; he complains chiefly of pain in the legs; there is

marked hyperæsthesia of the calf muscles; the pulse is 80 when lying down and 88 on sitting up; the respirations are 24. On the seventy-fourth day he was found to be suffering from severe suprapubic pain and could not void urine. He was taken to the prison hospital where he was catheterized. It was not necessary to use the catheter after the second day in the hospital. From the eightieth day on the patient was bedridden. On the eighty-



fourth day the following note was made: Pulse 80; marked epigastric pulsation; slight pulsation over the cardiac area; he complains of pain in the calves of the legs which are very tender on pressure; his gait is quite ataxic, the heart sounds are clear; the first sound is somewhat prolonged, but there is no distinct murmur; there is no foot nor wrist drop; the knee jerks are absent. On the eighty-fifth day the note reads: Patient says he feels no particular discomfort when lying down, but suffers from

discomfort in the chest and pains in the legs on getting up. Systolic blood pressure 95 millimeters Hg. Eighty-seventh day, pulse 72; still marked tenderness of calves and general weakness. No præcordial but slight epigastric pulsation. On the ninetieth day, pulse 84, respirations 24. Complains of much pain in the legs. He suffers from weakness and can no longer walk by himself. The knee jerks are absent. For the next few days the patient remained in about the same condition, but grew slightly weaker. On the ninety-seventh day the diet was discontinued. At this time he could just stand and was very weak. Pulse 80. Slight foot drop was present. This man evidently suffered from beriberi. During the last three weeks of the experiment the urine was examined each day and was always found to be greatly decreased in amount. Frequently the daily output was less than 500 cubic centimeters. It never contained albumin nor casts.

CASE NO. 12 (GROUP II).

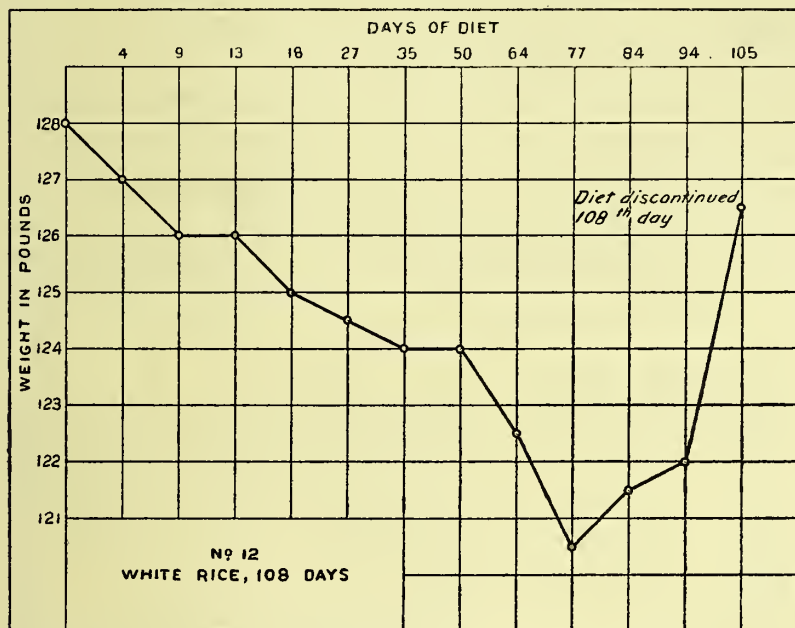
Diet: White polished rice 108 days, together with the special diet common to all the groups.

Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: Fairly well-nourished man; percussion and auscultation of the lungs show nothing abnormal; examination of the heart shows no increase in the area of cardiac dulness; the point of maximum impulse is invisible; it is palpable 8 centimeters to the left of the median line and 2.5 centimeters below the nipple line; the heart sounds are clear at the apex and base; the pulse is 88, and the systolic blood pressure 118 millimeters Hg (Faught); there is no epigastric pulsation; the liver and spleen are not palpable, and the liver dulness is not increased upward; the knee jerks are active.

The patient lost weight steadily up to the seventy-seventh day of the experiment. The knee jerks were active during this time. The earlier notes are otherwise unimportant, except that on the seventy-fourth day he complained of headache, dizziness, and marked weakness. The pulse was 110, and both knee jerks were found to be very weak. The apex beat of the heart was now palpable in the nipple line. The heart sounds were normally spaced, and there were no murmurs. The cardiac dulness was not distinctly changed. The patient remained in bed and ate no dinner nor supper. The following three days he stayed for the most of the time in bed, eating but little, but on the seventy-seventh day he was up and began to eat better. The knee jerks were active. On the eighty-fifth day the systolic blood pressure was

90 millimeters Hg. On the ninetieth day the note was made that he states that he feels well. The knee jerks are active. By the ninety-fifth day he had gained 0.6 kilogram (1.5 pounds) in weight. On the ninety-seventh day, as already mentioned, it became necessary to add codfish and potatoes to the diet. On the ninety-eighth day at noon he complained of pain and tenderness in the calves of the legs and of disturbance of vision. The pulse was 92. On the ninety-ninth day the note was made: Point of maximum impulse invisible; palpable in the same position as on the thirtieth day. No pulsation over cardiac area. Slight visible epigastric pulsation. There is a very faint systolic murmur at



the apex, which is not transmitted to the base. The second pulmonary sound is slightly accentuated. He states that his feet feel heavy, as though he could not lift them easily, and complains of pain in the calves of the legs and in his eyes. The calves are tender on pressure. There is very slight prætibial pitting. The knee jerks are present. On the one hundredth day the pulse was rather weak. The calves remained tender. On the one hundred first day the pulse was 100; the patient complained of headache, and marked œdema of the lower legs had developed. The knee jerks were active. The patient remained in about the same condition during the next few days. On the one hundred sixth day it was noted that the knee jerks were active and there

was still marked œdema of the legs but the calves seemed no longer tender. On the one hundred eighth day it was necessary to discontinue the diet, owing to the reasons already stated under the other cases. The following note was made on this day: Pulse 80, a little feeble; no throbbing over the cardiac area: point of maximum impulse not distinctly visible nor palpable; the first sound is considerably prolonged at the apex; he complains of pains in the legs and eyes; there is marked œdema of the legs and tenderness on pressure; the knee jerks are active.

TABLE IV.—*Record of rations consumed by prisoners of Group II.*

Prisoner number.	Kind of rice.						Duration of experiment.					
7	} White rice, 97 days; red rice, 20 days.....						117 days, January 17 to May 12.					
8												
11	} White rice.....						97 days, January 17 to April 22.					
9												
10	} White rice.....						108 days, January 17 to May 3.					
12												

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	7	11	10	12	9	8		7	11	10	12	9	8
<i>Day 1.</i>							<i>Day 5.</i>						
Rice	300	300	300	300	300	300	Rice	200	200	200	200	200	200
Bacon	50	50	50	50	50	50	Bread	150	150	150	150	150	150
<i>Day 2.</i>							Bacon	30	30	30	30	30	30
Rice	300	300	300	300	300	300	Bread	200	200	200	200	200	200
Onions	100	100	100	100	100	100	Rice	100	100	100	100	100	100
Lard	15	15	15	15	15	15	Starch	50	0	50	50	50	0
Rice	300	300	300	300	300	300	Sugar	25	0	25	25	25	0
Bananas	150	150	150	150	150	150	Lard	20	0	20	20	20	0
Sugar	75	75	75	75	75	75	<i>Day 6.</i>						
<i>Day 3.</i>							Rice	300	300	300	300	300	300
Bread	150	100	100	150	100	100	Onions	100	100	100	100	100	100
Rice	100	100	100	100	100	100	Lard	15	15	15	15	15	15
Starch	50	50	50	25	25	50	Rice	300	300	300	300	300	300
Sugar	25	25	25	15	15	25	Bacon	50	50	50	50	50	50
Lard	20	20	20	10	10	20	<i>Day 7.</i>						
Rice	300	300	300	300	150	300	Rice	300	300	300	300	300	300
Bacon	50	50	50	50	50	50	Bananas	100	100	100	100	100	100
<i>Day 4.</i>							Sugar	25	25	25	25	25	25
Rice	250	300	300	300	300	300	Bread	200	200	200	200	200	0
Onions	100	100	100	100	100	100	Rice	100	100	100	100	100	0
Lard	15	15	15	15	15	15	Starch	0	50	50	0	50	0
Rice	300	300	300	300	300	300	Sugar	0	25	25	0	25	0
Bananas	150	150	150	150	150	150	Lard	0	20	20	0	20	0
Sugar	75	75	75	75	75	75							

TABLE IV.—Record of rations consumed by prisoners of Group II—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	7	11	10	12	9	8		7	11	10	12	9	8
<i>Day 8.</i>							<i>Day 14—Ctd.</i>						
Rice	300	300	300	300	300	150	Rice	350	350	350	350	350	350
Bacon	50	50	50	50	50	50	Onions	25	100	50	25	25	125
Rice	0	175	175	175	175	0	Lard	0	10	10	0	0	15
Onions	0	0	150	0	75	75	<i>Day 15.</i>						
Lard	0	0	20	0	10	10	Rice	0	50	100	75	100	50
<i>Day 9.</i>							Starch	0	25	50	40	50	25
Bread	150	150	150	150	150	150	Sugar	0	125	25	15	25	125
Rice	200	0	200	200	200	200	Lard	0	10	20	15	20	10
Bacon	30	30	30	30	30	30	Bread	150	150	150	(a)	150	150
Rice	0	0	300	0	300	0	Rice	200	200	200	(a)	200	200
Bananas	150	150	150	150	150	150	Bacon	50	50	50	(a)	50	50
Sugar	75	75	75	75	75	75	<i>Day 16.</i>						
<i>Day 10.</i>							Rice	300	300	300	300	300	300
Rice	300	300	300	300	300	300	Sugar	25	25	25	25	25	25
Bacon	50	50	50	50	50	50	Bananas	100	100	100	100	100	100
Bread	200	200	200	200	200	200	Rice	300	350	350	350	350	350
Rice	100	100	50	100	100	100	Onions	130	150	150	150	150	150
Starch	50	50	50	50	50	50	Lard	15	20	20	20	20	20
Sugar	25	25	25	25	25	25	<i>Day 17.</i>						
Lard	20	20	20	20	20	20	Bread	150	150	150	150	100	75
<i>Day 11.</i>							Rice	100	100	130	100	200	200
Rice	300	300	300	300	300	300	Bacon	30	30	30	30	30	30
Onions	0	0	100	100	100	100	Rice	225	225	300	275	200	100
Lard	0	0	15	15	15	15	Bananas	150	150	150	150	150	150
Rice	300	300	300	300	300	300	Sugar	75	38	75	75	75	75
Bacon	50	50	50	50	50	50	<i>Day 18.</i>						
<i>Day 12.</i>							Rice	300	300	300	300	260	260
Bread	150	150	150	150	150	150	Onions	70	100	100	85	100	100
Rice	200	200	200	200	200	200	Lard	10	15	15	10	15	15
Bacon	30	30	30	30	30	30	Bread	200	200	200	200	200	200
Rice	300	300	350	350	300	350	Rice	35	0	75	75	100	100
Onions	25	25	125	150	25	150	Starch	50	50	25	25	50	50
Lard	0	0	15	20	0	20	Sugar	25	25	13	13	25	25
<i>Day 13.</i>							Lard	20	20	10	10	20	20
Bread	150	25	150	150	80	50	<i>Day 19.</i>						
Rice	0	175	25	125	35	25	Rice	300	300	300	300	300	300
Starch	0	0	0	0	0	0	Bacon	50	50	50	50	50	50
Sugar	0	0	0	0	0	0	Rice	300	300	300	300	300	300
Lard	0	0	0	0	0	0	Sugar	75	75	75	75	75	75
Rice	300	300	300	300	300	300	Bananas	150	150	150	150	150	150
Sugar	75	75	75	75	75	75	<i>Day 20.</i>						
Bananas	150	150	150	150	150	150	Rice	75	300	300	300	300	300
<i>Day 14.</i>							Onions	100	100	100	30	100	100
Rice	300	300	300	300	300	300	Lard	15	15	15	5	15	15
Bacon	50	50	50	50	50	50	Bread	200	200	200	200	200	150

^a Prison rations.

TABLE IV.—Record of rations consumed by prisoners of Group II—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	7	11	10	12	9	8		7	11	10	12	9	8
<i>Day 20—Ctd.</i>							<i>Day 27.</i>						
Rice	30	75	65	65	75	85	Rice	100	260	300	200	300	150
Starch	20	40	35	35	40	45	Onions	0	100	100	50	100	50
Sugar	10	20	20	20	20	20	Lard	0	15	15	8	15	8
Lard	5	15	15	15	15	15	Bread	100	65	200	175	150	100
<i>Day 21.</i>							Rice	65	50	65	17	75	33
Rice	300	300	300	300	300	300	Starch	33	25	33	10	37	17
Bananas	100	100	100	100	100	100	Sugar	17	13	17	4	20	8
Sugar	0	0	0	0	0	0	Lard	7	10	7	4	15	7
Rice	300	300	300	300	300	300	<i>Day 28.</i>						
Bacon	50	50	50	50	50	50	Rice	150	300	300	300	300	275
<i>Day 22.</i>							Bacon	50	25	50	50	50	50
Rice	200	200	200	200	200	200	Rice	200	150	300	40	200	40
Bacon	30	30	30	30	30	30	Bananas	150	150	150	150	150	150
Bread	150	75	150	150	150	20	Sugar	0	0	0	0	0	0
Rice	350	350	350	350	350	350	<i>Day 29.</i>						
Onions	150	150	150	150	150	150	Bread	0	0	0	0	0	0
Lard	20	20	20	20	20	20	Rice	0	0	0	0	0	0
<i>Day 23.</i>							Starch	0	0	0	0	0	0
Rice	300	300	300	300	300	300	Sugar	0	0	0	0	0	0
Bacon	50	50	50	50	50	50	Lard	0	0	0	0	0	0
Rice	300	300	300	300	300	300	Rice	175	175	350	250	250	310
Sugar	0	0	0	0	0	0	Onions	150	0	150	150	75	0
Bananas	150	150	150	150	150	150	Lard	20	0	20	20	10	0
<i>Day 24.</i>							<i>Day 30.</i>						
Bread	150	135	150	115	135	150	Rice	200	200	200	200	200	200
Rice	20	20	35	20	85	0	Bread	75	150	150	50	150	75
Starch	10	10	15	10	40	0	Bacon	30	30	30	30	30	30
Sugar	5	5	10	5	20	0	Rice	150	200	200	300	150	200
Lard	5	5	10	5	15	0	Bread	150	150	150	0	100	0
Rice	300	300	300	300	300	300	Bacon	50	50	50	50	50	50
Bacon	50	50	50	50	50	50	<i>Day 31.</i>						
<i>Day 25.</i>							Rice	225	200	250	200	100	150
Rice	0	200	165	175	200	200	Bananas	150	150	150	150	150	150
Bread	150	0	150	150	150	0	Sugar	0	0	0	0	0	0
Bacon	30	30	30	30	30	30	Rice	0	150	225	300	150	150
Dinner	No record.						Onions	0	50	100	100	50	50
<i>Day 26.</i>							Lard	0	7	15	15	7	7
Rice	200	300	300	150	250	200	<i>Day 32.</i>						
Bananas	100	100	100	100	100	100	Rice	180	200	200	200	200	200
Sugar	0	0	0	0	0	0	Bread	135	35	135	150	135	0
Rice	300	300	300	300	300	300	Bacon	30	15	30	30	30	30
Bacon	50	50	50	50	50	50	Rice	260	300	300	260	225	260
							Bacon	50	50	50	50	50	50

TABLE IV.—Record of rations consumed by prisoners of Group II—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	7	11	10	12	9	8		7	11	10	12	9	8
<i>Day 47.</i>							<i>Day 54.</i>						
Rice	225	240	300	100	260	200	Rice	100	200	300	300	100	
Bananas	100	100	100	100	100	100	Bananas	100	100	100	100	100	
Sugar	0	0	0	0	0	0	Sugar	0	0	0	0	0	
Rice	0	125	0	125	35	125	Rice	300	350	315	350	310	
Onions	0	0	0	0	0	0	Onions	0	0	0	0	0	
<i>Day 48.</i>							<i>Day 55.</i>						
Rice	0	0	300	150	300	225	Rice	100	225	175	175	175	
Bacon	50	25	50	50	50	50	Bacon	0	50	50	50	50	
Rice	300	260	300	270	300	300	Rice	250	300	300	300	300	
Bananas	150	150	150	150	150	150	Bananas	150	150	150	150	150	
Sugar	0	0	0	0	0	0	Sugar	0	0	0	0	0	
<i>Day 49.</i>							<i>Day 56.</i>						
Rice	175	200	175	175	200	200	Rice	200	200	160	0	200	
Bread	150	135	110	50	75	0	Bread	0	120	135	110	135	
Bacon	0	30	30	25	30	30	Bacon	0	30	30	30	15	
Rice	350	235	315	300	350	300	Rice	350	350	300	260	350	
Onions	0	150	150	0	75	75	Onions	50	50	150	0	0	
<i>Day 50.</i>							<i>Day 57.</i>						
Rice	300	300	300	300	300	300	Rice	240	300	270	225	300	
Onions	50	150	75	150	75	100	Onions	100	0	0	0	100	
Rice	300	300	300	250	200	200	Rice	0	190	260	260	260	
Bananas	150	150	150	150	150	150	Bananas	150	150	150	150	150	
Sugar	0	0	0	0	0	0	Sugar	0	0	0	0	0	
<i>Day 51.</i>							<i>Day 58.</i>						
Rice	300	250	150	300	270	360	Rice	0	0	0	225	35	150
Bananas	100	100	100	100	100	100	Bananas	100	100	100	100	100	100
Sugar	0	0	0	0	0	0	Sugar	0	0	0	0	0	0
Rice	300	300	300	300	300	300	Rice	300	300	225	300	240	240
Bacon	50	50	50	50	50	50	Bacon	50	50	50	50	50	25
<i>Day 52.</i>							<i>Day 59.</i>						
Rice	300	300	300	300	250	300	Rice	300	150	150	300	240	300
Bacon	50	35	0	0	50	50	Bacon	50	25	50	50	50	50
Rice	280	350	125	350	315	350	Rice	265	175	175	350	0	310
Onions	0	0	0	0	0	0	Onions	150	0	150	150	0	75
<i>Day 53.</i>							<i>Day 60.</i>						
Rice	160	150	70	200	200	200	Rice	150	100	200	200	200	70
Bread	75	75	75	150	75	150	Bread	110	65	110	0	150	150
Bacon	30	30	0	30	30	30	Bacon	0	30	30	30	30	30
Rice	300	300	300	300	300	300	Rice	300	250	300	260	250	260
Bananas	150	150	150	150	150	150	Bananas	150	150	150	150	150	150
Sugar	0	0	0	0	0	0	Sugar	0	0	0	0	0	0

TABLE IV.—Record of rations consumed by prisoners of Group II—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	7	11	10	12	9	8		7	11	10	12	9	8
Day 61.							Day 68.						
Rice	300	150	225	300	150	150	Rice	300	250	240	300	100	80
Bananas	100	100	100	100	100	100	Bananas	150	150	150	150	150	150
Sugar	0	0	0	0	0	0	Sugar	0	0	0	25	0	0
Rice	175	175	85	35	45	125	Rice	260	175	0	225	175	0
Onions	0	0	0	0	0	0	Onions	0	0	0	0	0	0
Day 62.							Day 69.						
Rice	200	250	100	150	200	225	Rice	150	200	0	300	50	40
Bacon	0	50	25	50	50	25	Bacon	50	50	50	50	50	25
Rice	270	250	250	100	100	100	Rice	250	100	150	150	75	50
Bananas	150	150	150	150	150	150	Bananas	150	150	150	150	150	150
Sugar	0	0	0	0	0	0	Sugar	0	0	0	25	0	0
Day 63.							Day 70.						
Rice	200	175	50	200	160	25	Rice	0	0	35	250	0	250
Bread	150	150	150	135	150	150	Onions	0	0	0	0	0	0
Bacon	0	30	15	30	30	30	Rice	0	(b)	150	260	300	30
Rice	350	260	350	350	310	350	Bacon	0	(b)	50	50	50	50
Onions	0	75	0	150	0	75	Day 71.						
Day 64.							Rice	200	25	200	175	200	50
Rice	300	300	300	300	300	300	Bread	150	150	150	100	150	0
Onions	0	75	0	0	0	0	Bacon	30	30	30	30	30	30
Rice	300	(a)	225	300	300	260	Rice	300	0	35	150	150	300
Bananas	150	(a)	150	150	150	150	Bananas	150	150	150	150	150	150
Sugar	0	(a)	25	25	25	0	Sugar	25	0	0	0	0	25
Day 65.							Day 72.						
Rice	300	225	150	225	260	225	Rice	240	0	150	260	30	0
Bananas	100	100	100	100	100	100	Bacon	50	50	50	50	50	50
Sugar	0	25	0	25	0	25	Rice	175	125	310	225	45	225
Rice	200	270	225	300	300	260	Onions	150	0	0	150	0	150
Bacon	50	50	25	50	50	50	Lard	20	0	0	20	0	20
Day 66.							Day 73.						
Rice	300	(b)	300	300	300	260	Rice	No record kept.					
Onions	100	(b)	100	100	100	100	Bananas						
Lard	15	(b)	15	15	15	15	Sugar						
Rice	300	(b)	255	225	300	225	Rice						
Bananas	150	(b)	150	150	150	0	Onions						
Sugar	0	(b)	0	25	25	0	Lard						
Day 67.							Day 74.						
Rice	0	0	170	170	200	100	Rice	0	0	0	0	0	0
Bread	150	75	150	150	150	100	Bread	0	0	0	0	0	0
Bacon	0	30	30	30	30	30	Bacon	0	0	0	0	0	0
Rice	225	350	350	225	225	290	Rice	0	0	0	0	0	0
Onions	0	0	0	0	0	0	Bananas	0	0	0	0	0	0
							Sugar	0	0	0	0	0	0

^a Vomiting.^b Left with prisoner.

TABLE IV.—Record of rations consumed by prisoners of Group II—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	7	11	10	12	9	8		7	11	10	12	9	8
Day 75.							Day 83.						
Rice	0	0	0	0	0	0	Rice	300	225	300		35	
Bananas	0	0	0	0	0	0	Onions	0	0	0		0	
Sugar	0	0	0	0	0	0	Rice	100	150	75		150	
Rice	Food left with them and no record kept.						Bananas	150	150	150		150	
Bacon							Sugar	0	0	0		0	
Day 76.							Day 84.						
Rice	0	0	0	0	100	0	Rice	300	300	300		300	
Onions	0	0	0	0	0	0	Bacon	50	50	50		0	
Rice	260	240	200	300	200	30	Rice	0	125	0		35	
Bacon	50	50	50	50	50	0	Onions	0	0	0		0	
Day 77.							Day 85.						
Rice	150	30	50	240	0	30	Rice	300	200	225		260	
Bananas	100	100	100	100	100	100	Bananas	100	100	100		100	
Sugar	0	25	0	25	25	10	Sugar	0	0	0		0	
Rice	240	0	150	200	50	35	Rice	300	240	300		150	
Bacon	0	0	0	50	50	50	Bacon	0	0	0		0	
Day 78.							Day 86.						
Rice	200	200	200	200	170	20	Rice	200	150	175		50	
Bread	150	150	150	150	150	75	Bread	150	150	150		150	
Bacon	30	30	30	30	30	0	Bacon	0	0	30		0	
Rice	260	(a)	225	290	70	175	Rice	350	35	125		0	
Onions	150	(a)	50	150	150	150	Onions	0	0	0		0	
Lard	20	(a)	10	20	20	20	Day 87.						
Day 79.							Rice	225	225	260		225	
Rice	300	(a)	225	0	300	30	Bacon	0	50	50		0	
Bacon	0	(a)	0	50	50	0	Rice	150	35	75		35	
Rice	300	(b)	100	150	150	200	Bananas	150	150	150		150	
Bananas	150		150	150	150	150	Sugar	0	0	0		0	
Sugar	0		0	0	0	0	Day 88.						
Day 80.							Rice	0	300	300		150	
Rice	300		250	260	0	100	Onions	0	0	0		0	
Onions	0		0	0	0	0	Rice	150	200	300		75	
Rice	300		150	200	150	50	Bacon	25	50	50		50	
Bacon	50		50 ^a	50	50	50	Day 89.						
Day 81.							Rice	0	225	300		100	
Rice	300		250	150	150	25	Bananas	100	100	100		0	
Bananas	100		100	100	100	100	Sugar	25	25	25		25	
Sugar	0		0	0	0	10	Rice	60	120	350		35	
Rice	260		85	45	0	85	Onions	0	0	0		0	
Onions	0		40	0	0	0	Day 90.						
Lard	0 ^b		10 ^b	0	0	0	Rice	0	150	200		100	
Day 82.							Bread	150	0	150		0	
Rice	200		200	200	(b)	150	Bacon	30	30	30		15	
Bread	150		150	150		110	Rice	0	35	300		25	
Bacon	30		30	30		30	Bacon	15	25	50		15	
Rice	35		35	70		35							
Bacon	50		50	50		50							

^a Left with prisoner.^b In hospital, diet furnished; amount eaten not recorded from this date.

TABLE IV.—Record of rations consumed by prisoners of Group II—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	7	11	10	12	9	8		7	11	10	12	9	8
<i>Day 91.</i>							<i>Day 98—Ctd.</i>						
Rice	300		300	300		240	Potatoes	150		150	150		150
Onions	100		100	100		0	Bacon	0		25	50		0
Lard	15		15	15		0	<i>Day 99.</i>						
Rice	0		0	0		75	Rice	0		(b)	(b)		150
Bananas	0		150	150		150	Potatoes	150		(b)	(b)		75
Sugar	0		0	0		0	Bacon	30		(b)	(b)		15
<i>Day 92.</i>							Rice	300		100	300		225
Rice	300		300	300		185	Fish	30		15	30		30
Bacon	50		50	50		50	<i>Day 100.</i>						
Rice	350		85	85		25	Rice	300		260	300		0
Onions	150		150	150		0	Bananas	100		100	100		0
Lard	20		20	20		0	Sugar	0		0	0		0
<i>Day 93.</i>							Rice	200		175	165		200
Rice	185		35	185		200	Bread	150		135	135		150
Bananas	100		100	100		100	Bacon	30		0	30		30
Sugar	5		25	5		0	<i>Day 101.</i>						
Rice	300		300	300		240	Rice	300		300	300		300
Bacon	50		50	50		50	Fish	25		25	25		25
<i>Day 94.</i>							Potatoes	100		100	100		100
Rice	175		100	200		0	Rice	350		175	350		85
Bread	150		120	150		35	Onions	0		0	0		0
Bacon	30		30	30		30	<i>Day 102.</i>						
Rice	350		300	300		100	Rice	300		300	300		300
Onions	150		125	150		150	Fish	40		40	40		40
<i>Day 95.</i>							Rice	300		50	300		260
Rice	300		300	300		75	Potatoes	100		100	100		100
Bacon	50		50	50		25	Bacon	30		30	30		30
Rice	200		150	100		0	<i>Day 103.</i>						
Bananas	150		150	150		150	Rice	300		225	150		300
Sugar	0		0	0		0	Potatoes	100		100	100		100
<i>Day 96.</i>							Fish	30		30	30		30
Rice	300		150	240		0	Starch	10		10	10		10
Onions	0		0	0		0	Lard	15		15	15		15
Rice	150		200	250		75	Rice	300		35	75		300
Bacon	50		50	50		50	Bacon	0		0	0		50
<i>Day 97.</i>							<i>Day 104.</i>						
Rice	150	(a)	250	200	(a)	0	Rice	300		0	0		300
Bananas	100		100	100		100	Potatoes	100		100	100		100
Sugar	0		0	0		0	Bacon	30		30	30		30
Rice	300		150	225		25	Rice	300		75	150		260
Fish	30		30	30		30	Bananas	150		150	150		150
<i>Day 98.</i>							Sugar	5		0	0		0
Rice	200		300	300		200	<i>Day 105.</i>						
Fish	0		30	30		30	Rice	300		200	250		300
Rice	300		100	225		75	Fish	30		30	30		30

^a Diet discontinued.^b Not recorded.

TABLE IV.—Record of rations consumed by prisoners of Group II—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	7	11	10	12	9	8		7	11	10	12	9	8
<i>Day 105—Ctd.</i>							<i>Day 112.</i>						
Rice	300		75	260		300	Rice	300					300
Potatoes	100		100	100		100	Fish	30					30
Bacon	30		30	30		30	Rice	300					300
<i>Day 106.</i>							<i>Day 113.</i>						
Rice	300		150	300		300	Rice	300					300
Potatoes	100		100	100		100	Potatoes	100					100
Fish	30		30	30		30	Fish	30					30
Rice	300		75	100		260	Rice	300					300
Bananas	150		150	150		150	Bacon	50					50
Sugar	0		0	10		20	<i>Day 114.</i>						
<i>Day 107.</i>							<i>Day 115.</i>						
Rice	300		150	300		300	Rice	300					300
Bacon	50		50	50		50	Potatoes	100					100
Rice	}	No record kept.					Fish	30					30
Potatoes							Rice	300				300	
Fish							Bananas	150				150	
<i>Day 108.</i>							Sugar	25					25
Rice	300		0	300		300	<i>Day 116.</i>						
Bananas	100		0	100		100	Rice	300					300
Sugar	25		0	25		25	Potatoes	100					100
Rice	300		(a)	(a)		300	Bacon	30					30
Potatoes	100					100	Rice	300					300
Bacon	30					30	Potatoes	100					100
<i>Day 109.</i>							Bacon	30					30
Rice	240					300	Rice	300					300
Fish	0					0	Fish	30					30
Starch	0					0	<i>Day 117.</i>						
Lard	0					0	Rice	300					300
Dinner	No record kept.						Potatoes	100					100
<i>Day 110.</i>							Bacon	30					30
Rice	300					300	Rice	300					300
Potatoes	100					100	Sugar	25					25
Bacon	30					30	Bananas	150					150
Rice	300					300	<i>Day 118.</i>						
Potatoes	100					100	Rice	300					300
<i>Day 111.</i>							Potatoes	100					100
Rice	300					300	Fish	30					30
Bananas	150					150	Rice	300					300
Sugar	25					25	Bacon	50					50
Rice	190					300	End of experiment.						
Potatoes	100					100							
Bacon	30					30							

^a Diet discontinued.

GROUP III.

CASE NO. 13 (GROUP III).

Diet: White rice + rice polishings for 17 days followed by red rice for 100 days, together with the special diet common to all the groups.	}	Total period of experi- ment, 117 days.
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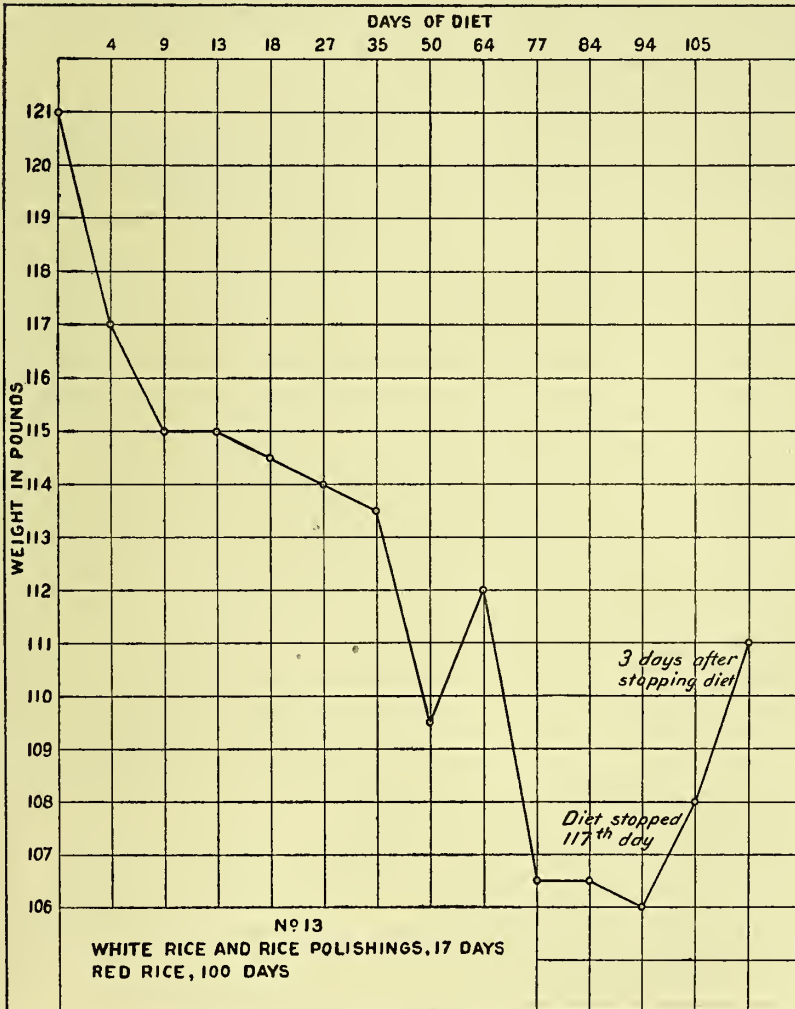
Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: Well-nourished man; percussion and auscultation of the lungs reveal nothing abnormal; examination of the heart shows no increase in the area of cardiac dulness; the point of maximum impulse is visible and palpable 6.25 centimeters to the left of the median line and 3 centimeters below the nipple line; the heart sounds are clear at the apex and base; there is no epigastric pulsation; the pulse is 80, and the systolic blood pressure is 118 millimeters Hg (Faught); the spleen and liver are not enlarged; the knee jerks are active.

The notes during the earlier days of the experiment are unimportant, except that the patient lost steadily in weight. On the seventy-fourth day he complained of weakness and pain in the epigastrium, and the note states that he had been eating little for the past five days. On the seventy-fourth day the note made was as follows: Pulse 110; heart sounds clear; point of maximum impulse distinctly visible and palpable as far out as the nipple line; no distinct change in the area of cardiac dulness; no tenderness of the calves of the legs; the right knee jerk is present but is a little weak, the left is slightly stronger. He was eating his rice well until the sixty-ninth day of the experiment; since that day he has eaten but little. On the seventy-seventh day the pulse was 104, and he complained of pain in the epigastrium and back and of having sensations of cold below his elbows and below his knees; he states that his hands feel colder than his face or neck; there is marked throbbing over the cardiac area; the impulse is palpable over an area of 4 to 5 centimeters in diameter; the respirations are 40; the heart sounds at the apex are normal, while near the base the spacing of the beats is more nearly equal; there is still no distinct increase in the area of dulness; the knee jerks can not be elicited after repeated trials. At 4 p. m. the pulse was 110; there was marked dyspnœa. On the seventy-eighth day at noon the note reads: Still marked pulsation over cardia and well-marked dyspnœa; right knee jerk not elicited, left questionable; pulse 104 before and 112 after slight exertion; the first sound at the apex

seems a little less prolonged than yesterday; he complains of pain in the region of the heart; at 4 p. m. the pulse was 102; respirations 40. On the eighty-first day the note states: Complains of pain in chest and abdomen; both knee jerks are elicited to-day but are very weak; pulse 120; respirations 40; there is visible pulsation of the præcordial area, from about 2 centimeters to the left of the sternum extending transversely and obliquely downward to just below the nipple; the deep cardiac dulness begins at the lower border of the third rib; it extends to the left 2 centimeters outside of the nipple line and is not increased to the right of the sternum. On the eighty-third day the note reads: He says that he has felt better for the last two days, except at night, and that he sometimes feels hot and has pain in the abdomen and gastric distress; the pulse is not so rapid. On the eighty-fourth day the pulse was 90 and the respirations 44; the knee jerks were both elicited though weak. On the eighty-fifth day the systolic blood pressure was 100 millimeters Hg. From the ninetieth to the ninety-fifth day the knee jerks were present. He has lost 6.8 kilograms (15 pounds) since the beginning of the experiment, though he has been eating his rice fairly well since the eighty-fourth day. On the ninety-seventh day dried codfish and potatoes were added to the diet. On the ninety-eighth day he complained of some weakness; the pulse was 92. On the ninety-ninth day the note reads as follows: Complains of a sense of oppression in the epigastrium and over the chest and of headache; there is marked epigastric pulsation and marked visible throbbing over the cardiac area, extending outside of the nipple; the heart sounds are forcible, the second pulmonic is slightly accentuated; the knee jerks are very weak; the respirations are 48; pulse 104 and weak; the pains in the legs have disappeared but he complains of slight tenderness above the knees on pressure; there are no areas of distinct anæsthesia of the skin. On the one hundredth day the pulse had dropped to 88. On the one hundred second day there were some erosions on the corners of the lips which were touched with a solution of silver nitrate. On the one hundred seventeenth day it was necessary to discontinue the diet. He gradually improved from the ninety-seventh day. On the one hundred nineteenth day the following note was made: Nutrition fair; no epigastric pulsation; pulse 90, of fair volume; visible pulsation over the heart in the 4th and 5th interspaces within the nipple line; on palpation the impulse is felt even outside the

nipple line; the apex beat is rather diffuse; the point of maximum impulse is 7 centimeters to the left of the median line; the first sound at the apex is prolonged but there is no distinct murmur; the sounds at the base are clear; the deep area of dulness does not extend to the left outside of the nipple line, nor to the right of the right edge of the sternum; there is no tenderness of the calves of the legs, and no œdema of the legs; the knee jerks are present but are still weak. The examination of the urine shows no albumin and no casts.



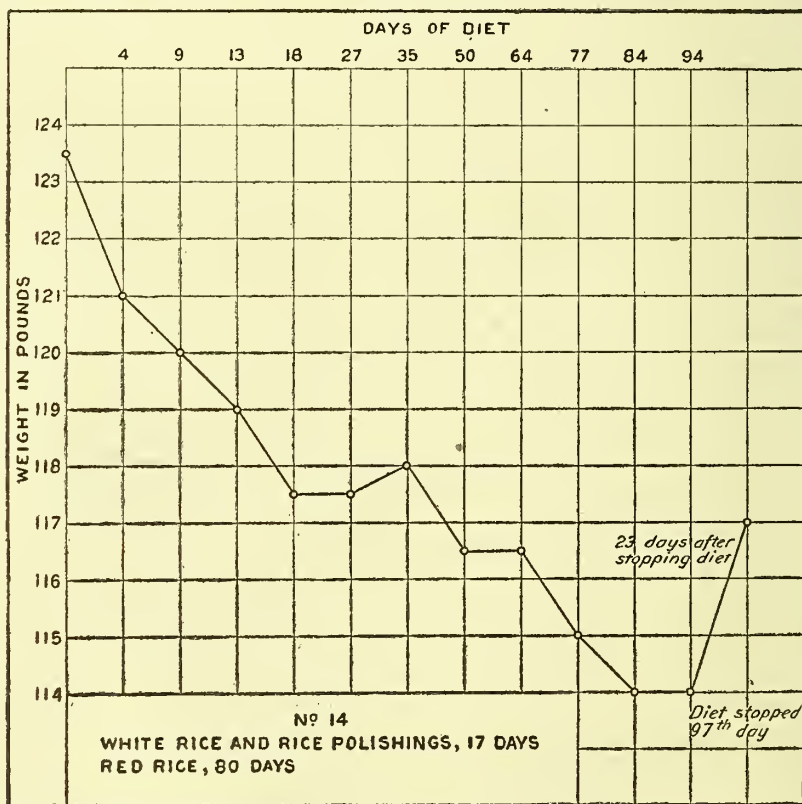
CASE NO. 14 (GROUP III).

Diet: White rice + rice polishings for 17 days
 followed by red rice for 80 days, together
 with the special diet common to all the
 groups.

Total period of experi-
 ment, 97 days.

Following is a brief summary of the notes of the case: Fairly well-nourished individual; percussion of lungs normal; respiratory sounds normal; area of cardiac dullness not increased beyond normal; point of maximum impulse visible 5.5 centimeters to the left of the median line and 2 centimeters below the nipple line; heart sounds clear at apex and base; no epigastric pulsation; spleen and liver not palpable below the costal margin; the knee jerks are active.

The notes of this case are unimportant except that the individual lost steadily in weight, and weighed 4.5 kilograms (10 pounds) less by the eightieth day of the experiment. On the



eighty-first day the note was made that the right knee jerk was very active but that the left seemed a little weak. On the eighty-fifth day the systolic blood pressure was 100 millimeters Hg. On the ninety-fifth day the knee jerks were both active. On the ninety-seventh day it became necessary to discontinue the diet as he refused to continue the experiment longer. At this time his condition was good, although he had lost 4.5 kilograms (10 pounds) in weight. The condition of the heart remained unchanged. The knee jerks were active and there was no œdema of the legs, tenderness of the calves of the legs, nor areas of anæsthesia of the skin. The urine was normal.

CASE NO. 15 (GROUP III).

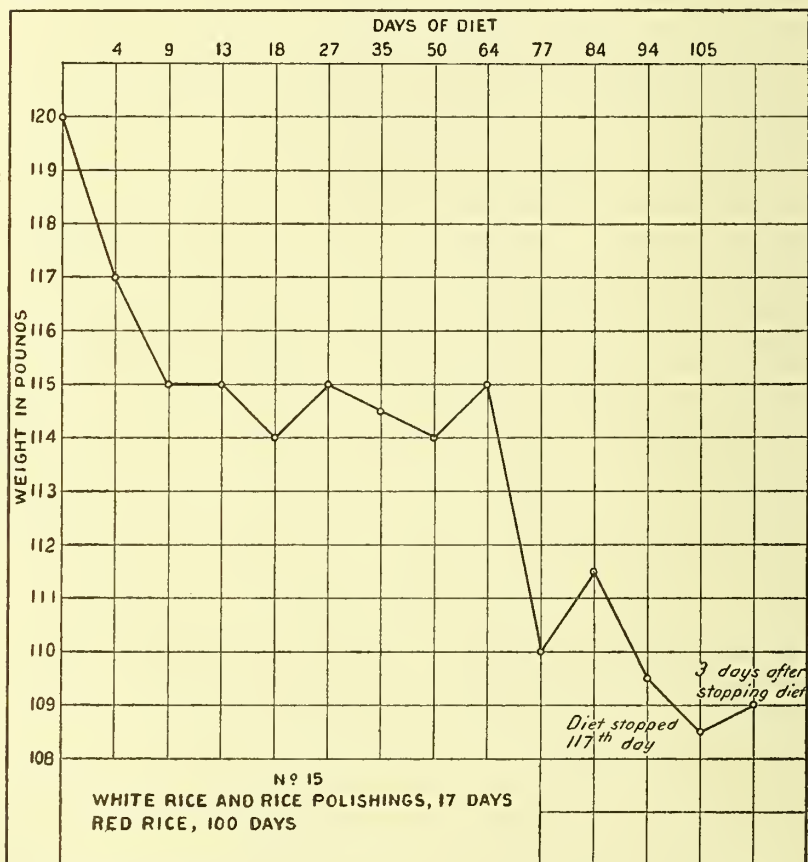
Diet: White rice + rice polishings for 17 days followed by red rice for 100 days, together with the special diet common to all the groups.	}	Total period of experi- ment, 117 days.
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Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: Percussion and auscultation of the lungs reveal nothing abnormal; the examination of the heart shows no increase in the area of cardiac dulness beyond the normal; the point of maximum impulse is palpable 7 centimeters to the left of the median line and 1 centimeter below the nipple line; the heart sounds are clear at the apex and base; there is no epigastric pulsation; the pulse is 72 and the systolic blood pressure 130 millimeters Hg (Faught); the spleen and liver are not enlarged; the knee jerks are active.

The earlier notes of this case show no important changes in the condition of the individual except that he lost weight gradually up to the seventy-seventh day of the experiment when he weighed 4.5 kilograms (10 pounds) less than when the experiment was begun. On the eighty-first day the systolic blood pressure was 100 millimeters Hg. On the ninetieth day the note states: He has eaten little for two days and complains of headache; there are no cardiac symptoms; his headache and loss of appetite were relieved by purgation; the knee jerks have been active throughout. On the ninety-seventh day dried codfish and potatoes were added to the diet. On the ninety-ninth day the following note was made: No throbbing over cardiac area; pulse 80; point of maximum impulse invisible; palpable within the nipple line; heart sounds clear and slightly accentuated at the base; the knee jerks are active; no increase in the cardiac

dulness; no œdema of the legs. On the one hundred fifth day his condition remained good. On the one hundred seventeenth day the diet was discontinued. On the one hundred nineteenth day the following note was made: Nutrition fair; pulse 80; no epigastric nor præcordial pulsation visible; point of maximum impulse not distinctly palpable; area of cardiac dulness not increased; heart sounds normal; knee jerks active; no œdema; no pain nor tenderness in the legs. He has had severe conjunctivitis and some erosions at the edges of the lips at times during the experiment, and has lost steadily in weight; in all 5.6 kilograms (11.5 pounds). The urine contains no albumin and no casts.

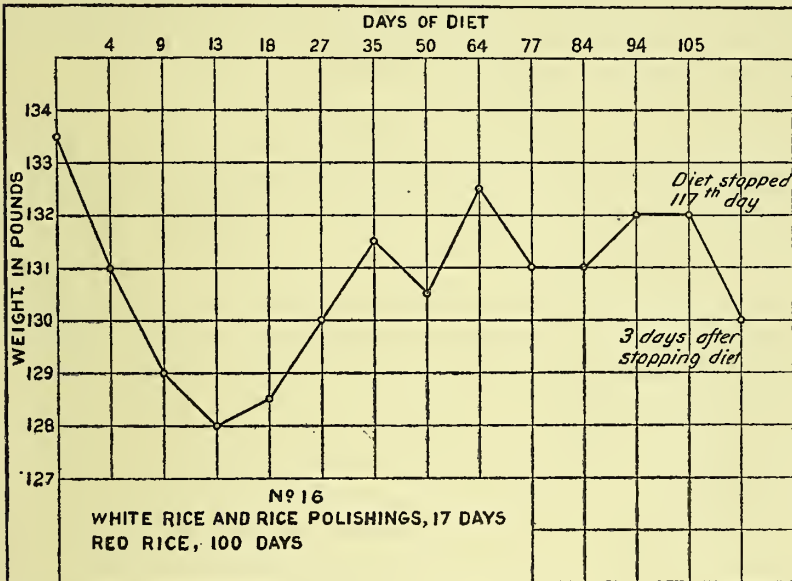


CASE NO. 16 (GROUP III).

Diet: White rice + rice polishings for 17 days }
 followed by red rice for 100 days, together } Total period of experi-
 with the special diet common to all the } ment, 117 days.
 groups. }

Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: Examination of the lungs shows nothing abnormal; examination of the heart shows the area of dulness is not increased beyond the normal limits; the point of maximum impulse is invisible; it is palpable 6 centimeters to the left of the median line and 4 centimeters



below the nipple line; the heart sounds are clear at the apex, and are faintly heard at the base; there is no epigastric pulsation; the pulse is 88, and the systolic blood pressure 120 millimeters Hg (Faught); the spleen and liver are not enlarged; the knee jerks are active.

The patient lost 2.2 kilograms (5 pounds) in weight before red rice was substituted for the white rice mixed with the rice polishings; then he began to gain in weight. On the fiftieth day of the diet the note reads: No hypertrophy nor dilatation of the heart; the sounds are clear; the knee jerks are active. The other notes are unimportant regarding the case. On the eighty-

fifth day the systolic blood pressure was 105 millimeters Hg. On the ninety-seventh day dried codfish and potatoes were added to the diet. On the ninety-ninth day the note reads as follows: Patient has had no physical complaint; there are no apparent changes in the condition of the heart; the pulse is 84; the knee jerks are very active; there is no œdema nor tenderness of the calves of the legs. On the one hundred seventeenth day it became necessary to discontinue the diet. On the one hundred nineteenth day the following note was made: Well nourished; pulse slow and regular; point of maximum impulse not visible; heart sounds unchanged; there is no pain in the calves of the legs and no œdema of the legs; the knee jerks are active; he says he feels as well as before he began the experiment. The urine contains no albumin and no casts.

CASE NO. 17 (GROUP III).

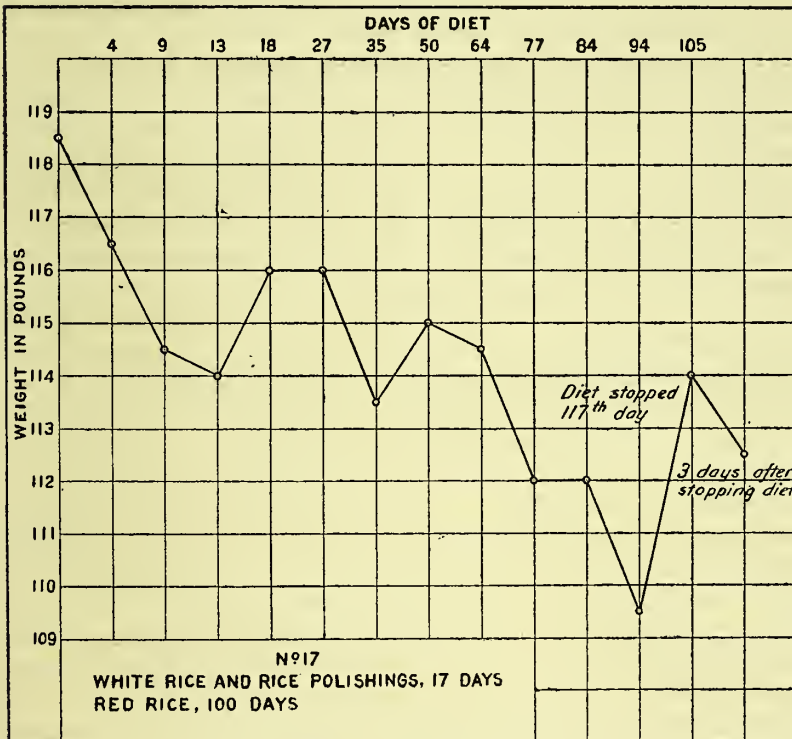
Diet: White rice + rice polishings for 17 days } followed by red rice for 100 days, together } with the special diet common to all the } groups. }	Total period of experiment, 117 days.
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Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: Percussion and auscultation of the lungs reveal nothing abnormal; examination of the heart shows no increase in the area of dulness beyond the normal; the point of maximum impulse is visible and palpable 7.5 centimeters to the left of the median line and 3.5 centimeters below the nipple line; the second sound at the apex is accentuated; at the base the sounds are not accentuated nor reduplicated; there are no murmurs, and no epigastric pulsation is visible; the pulse is 88, and the systolic blood pressure is 108 millimeters Hg (Faught); the liver and spleen are not palpable below the costal margin.

The notes of the case are unimportant except that the patient had lost 9 pounds (4 kilograms) in weight by the ninety-fourth day of the experiment. On the eighty-fifth day the systolic blood pressure was 95 millimeters Hg; the knee jerks remained active, and there was no complaint of pain. On the ninety-seventh day the following note was made: Point of maximum impulse not distinctly visible; palpable well within the nipple line; no pulsation over the cardiac area; the heart sounds have not changed since the previous note; the pulse is slow and regular; there is no œdema of the legs; the knee jerks are very active. On the one hundred fifth day the note states that his condition is good. During the experiment he has had at times catarrhal conjunctivitis but this has now disappeared. On the one hundred

seventeenth day the diet was discontinued and the prisoner returned to the regular prison ration. The next day the following note was made: Well-nourished individual; pulse 80; no epigastric nor præcordial pulsation; point of maximum impulse is not visible nor palpable; the heart sounds appear to be as at the beginning of the experiment; the area of cardiac dulness is not increased beyond the normal limits; there is no complaint of pain in the legs, and there is no œdema and no tenderness; the knee jerks are active; he says he feels well. From the ninety-seventh to the one hundred fifth day he gained 2.04 kilograms (4.5 pounds). The urine contained no albumin and no casts.



CASE NO. 18 (GROUP III).

Diet: White rice + rice polishings for 17 days
 followed by red rice for 100 days, together
 with the special diet common to all the
 groups. } Total period of experi-
 ment, 117 days.

Dried codfish and potatoes were added to the diet on the 97th day.

Following is a summary of the notes of the case: Percussion and auscultation of the lungs reveal nothing abnormal; the area

of cardiac dulness is not increased beyond the normal; the point of maximum impulse is not visible, and is but faintly palpable 7 centimeters to the left of the median line and 3 centimeters below the nipple line; the heart sounds are rapid but clear at the apex and base; there is no epigastric pulsation; the pulse is 100; the systolic blood pressure is 100 millimeters Hg (Faught); the spleen and liver are not palpable below the costal margin; the knee jerks are very active.

The earlier notes of the case are unimportant. On the forty-fourth day a vesiculo-pustular eruption appeared over the back and shoulders; this disappeared in a few days under local treatment. The patient lost 5 pounds in weight at the beginning of the experiment but later there was no further loss. The knee jerks remained active and the patient remained in good health. On the eighty-fifth day the systolic blood pressure was 105 millimeters Hg. On the ninety-seventh day of the experiment dried codfish and potatoes were added to the diet. On the ninety-ninth day the following note was made: Complains of headache; pulse 120, it misses a beat about every 10th pulsation; epigastric pulsation is visible; there is slight throbbing over the cardiac area; the impulse is palpable as far out as the nipple; the heart sounds are evenly spaced; they are forcible at the apex and much weaker at the base; there is no œdema of the legs, and the knee jerks are active. On the one hundred seventeenth day it became necessary to discontinue the diet. On the one hundred nineteenth day the following note was made: Fairly well nourished; no epigastric pulsation; pulse 100, occasionally intermitting a beat; the point of maximum impulse is not visible; it is palpable 7.5 centimeters to the left of the median line; just below the apex, the first and second heart sounds are of equal length; just above the apex, the first sound is a little more prolonged than the second sound; the sounds at the base are clear but weak; the area of cardiac dulness is not increased beyond normal; there is no œdema nor tenderness of the legs; he says he felt stronger before beginning the experiment. The urine showed no albumin and no casts.

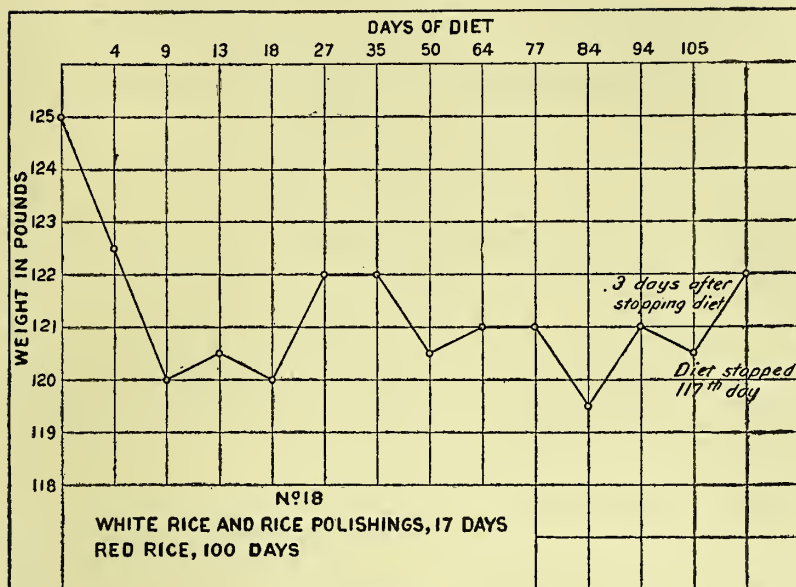


TABLE V.—Record of rations consumed by prisoners of Group III.

Prisoner number.	Kind of rice.	Duration of experiment.
14	White rice + rice polishings, 17 days; and red rice 80 days.	97 days, January 17 to April 22.
16	White rice + rice polishings, 17 days; and red rice 100 days.	117 days, January 17 to May 12.
18		
13		
15		
17		

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	14	16	18	13	17	15		14	16	18	13	17	15
<i>Day 1.</i>							<i>Day 3.</i>						
Rice	150	150	150	150	150	150	Bread	150	150	150	150	150	150
Bacon	50	50	50	50	50	50	Rice	100	100	100	100	100	100
<i>Day 2.</i>							Starch	0	0	0	0	25	0
Rice	0	0	0	0	0	0	Sugar	0	0	0	0	15	0
Onions	50	50	50	50	50	50	Lard	0	0	0	0	10	0
Lard	8	8	8	8	8	8	Rice	150	150	150	150	150	150
Rice	300	300	300	300	300	300	Bacon	0	0	0	0	0	0
Bananas	150	150	150	150	150	150	<i>Day 4.</i>						
Sugar	25	25	75	75	75	75	Rice	50	50	50	50	50	50
							Onions	100	100	100	100	100	100

TABLE V.—Record of rations consumed by prisoners of Group III—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	14	16	18	13	17	15		14	16	18	13	17	15
<i>Day 4—Ctd.</i>							<i>Day 10—Ctd.</i>						
Lard	15	15	15	15	15	15	Rice	0	0	0	0	0	0
Rice	50	50	50	50	50	50	Starch	0	0	0	0	0	0
Sugar	75	75	75	75	75	75	Sugar	0	0	0	0	0	0
Bananas	150	150	150	150	150	150	Lard	0	0	0	0	0	0
<i>Day 5.</i>							<i>Day 11.</i>						
Rice	50	50	50	50	50	50	Rice	0	0	0	0	0	0
Bread	150	150	150	150	150	150	Onions	100	100	100	100	100	100
Bacon	30	30	30	30	30	30	Lard	15	15	15	15	15	15
Bread	200	200	200	200	200	200	Rice	0	0	0	0	0	0
Rice	50	50	50	50	50	50	Bacon	50	50	50	50	50	50
Starch	50	50	50	50	50	50	<i>Day 12.</i>						
Sugar	25	25	25	25	25	25	Rice	0	0	0	0	0	0
Lard	20	20	20	20	20	20	Bread	150	150	150	150	150	150
<i>Day 6.</i>							Bacon	30	30	30	30	30	30
Rice	0	0	0	0	0	0	Rice	0	0	0	0	0	0
Onions	100	100	100	100	100	100	Onions	150	150	150	150	150	150
Lard	15	15	15	15	15	15	Lard	20	20	20	20	20	20
Rice	0	0	0	0	0	0	<i>Day 13.</i>						
Bacon	50	50	50	50	50	50	Bread	150	150	150	150	150	150
<i>Day 7.</i>							Rice	0	0	0	0	0	0
Rice	0	0	0	0	0	0	Starch	0	0	0	0	0	0
Bananas	100	100	100	100	100	100	Sugar	0	0	0	0	0	0
Sugar	0	0	0	0	0	0	Lard	0	0	0	0	0	0
Bread	200	200	200	200	200	200	Rice	240	240	225	240	250	250
Rice	0	0	0	0	0	0	Bananas	150	150	150	150	150	150
Starch	10	10	10	10	10	10	Sugar	75	75	75	75	75	75
Sugar	5	5	5	5	5	5	<i>Day 14.</i>						
Lard	5	5	5	5	5	5	Rice	300	300	250	300	225	300
<i>Day 8.</i>							Bacon	50	50	50	50	50	50
Rice	0	0	0	0	0	0	Rice	275	350	300	275	300	250
Bacon	50	0	50	50	50	0	Onions	100	150	150	100	150	150
Rice	0	0	0	0	0	0	Lard	15	20	20	15	20	20
Onions	150	150	0	150	150	0	<i>Day 15.</i>						
Lard	20	20	0	20	20	20	Rice	0	0	50	0	0	0
<i>Day 9.</i>							Starch	0	0	0	0	0	0
Bread	150	150	150	150	150	150	Sugar	0	0	0	0	0	0
Rice	0	0	0	0	0	0	Lard	0	0	0	0	0	0
Bacon	30	30	30	30	30	30	Rice	75	75	75	75	75	75
Rice	0	0	0	0	0	0	Bread	150	150	150	150	150	150
Bananas	150	150	150	150	150	150	Bacon	50	50	50	50	50	50
Sugar	75	75	75	75	75	75	<i>Day 16.</i>						
<i>Day 10.</i>							Rice	260	260	300	225	75	40
Rice	0	0	0	0	0	0	Sugar	25	25	25	25	25	25
Bacon	50	50	50	50	50	50	Bananas	100	100	100	100	100	100
Bread	200	200	200	200	200	200	Rice	310	260	350	350	175	235

TABLE V.—Record of rations consumed by prisoners of Group III—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	14	16	18	13	17	15		14	16	18	13	17	15
Day 16—Ctd.							Day 23.						
Onions.....	150	150	150	150	150	150	Rice.....	300	300	300	300	300	300
Lard.....	20	20	20	20	20	20	Bacon.....	50	50	50	50	50	50
Day 17.							Rice.....	300	300	300	300	300	300
Bread.....	130	150	150	150	0	150	Sugar.....	0	0	0	0	0	0
Rice.....	75	0	20	100	200	0	Bananas.....	150	150	150	150	150	150
Bacon.....	0	0	0	0	30	0	Day 24.						
Rice.....	0	40	0	0	40	150	Bread.....	150	150	150	150	150	150
Bananas.....	150	150	150	150	150	0	Rice.....	15	85	75	50	15	15
Sugar.....	25	25	25	25	25	0	Starch.....	10	45	40	25	10	10
Day 18.							Sugar.....	5	20	20	15	5	5
Rice.....	0	0	0	0	0	0	Lard.....	5	15	15	10	5	5
Onions.....	100	100	100	100	100	100	Rice.....	300	300	300	300	300	300
Lard.....	15	15	15	15	15	15	Bacon.....	50	50	50	50	50	50
Bread.....	200	200	100	200	200	200	Day 25.						
Rice.....	100	100	100	100	100	100	Rice.....	200	200	200	200	200	200
Starch.....	20	50	50	50	50	50	Bread.....	150	150	150	150	150	150
Sugar.....	8	25	25	25	25	25	Bacon.....	30	30	30	30	30	30
Lard.....	6	20	20	20	20	20	Dinner.....	No record.					
Day 19.							Day 26.						
Rice.....	300	300	300	300	300	300	Rice.....	300	300	300	300	300	300
Bacon.....	50	50	50	50	50	50	Bananas.....	100	100	100	100	100	100
Rice.....	300	260	300	300	300	300	Sugar.....	25	25	25	10	25	10
Bananas.....	150	150	150	150	150	150	Rice.....	300	300	300	300	300	300
Sugar.....	75	75	75	75	75	75	Bacon.....	50	50	50	50	50	50
Day 20.							Day 27.						
Rice.....	300	300	300	300	300	300	Rice.....	300	300	300	270	0	300
Onions.....	100	100	100	100	100	100	Onions.....	100	100	100	100	0	100
Lard.....	15	15	15	15	15	15	Lard.....	15	15	15	15	0	15
Bread.....	140	175	150	175	200	150	Bread.....	150	200	200	200	200	200
Rice.....	100	85	100	100	100	100	Rice.....	0	35	15	25	0	0
Starch.....	50	40	50	50	50	50	Starch.....	0	15	10	15	0	0
Sugar.....	25	20	25	25	25	25	Sugar.....	0	10	5	10	0	0
Lard.....	20	15	20	20	20	20	Lard.....	0	5	2	5	0	0
Day 21.							Day 28.						
Rice.....	260	260	300	300	300	300	Rice.....	300	300	300	300	300	300
Bananas.....	100	100	50	50	100	100	Bacon.....	50	50	50	50	50	50
Sugar.....	10	25	25	25	10	25	Rice.....	225	300	300	260	150	300
Rice.....	300	300	300	300	300	300	Bananas.....	150	150	150	150	150	150
Bacon.....	50	50	50	50	50	50	Sugar.....	0	0	0	25	0	0
Day 22.							Day 29.						
Rice.....	200	200	200	200	200	200	Bread.....	150	150	150	150	150	150
Bacon.....	30	30	30	30	30	30	Rice.....	75	15	0	0	0	0
Bread.....	135	135	150	150	135	135	Starch.....	40	10	0	0	0	0
Rice.....	350	350	350	350	350	350	Lard.....	15	5	0	0	0	0
Onions.....	150	150	150	150	150	150	Sugar.....	25	25	25	25	25	25
Lard.....	20	20	20	20	20	20							

TABLE V.—Record of rations consumed by prisoners of Group III—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	14	16	18	13	17	15		14	16	18	13	17	15
<i>Day 29—Ctd.</i>							<i>Day 36.</i>						
Rice	350	350	350	350	350	350	Rice	300	300	300	300	300	300
Onions	150	150	150	150	150	150	Bacon	50	50	50	50	50	50
Lard	20	20	20	20	20	20	Rice	No record.					
<i>Day 30.</i>							Bananas						
Rice	200	200	200	200	200	200	Sugar						
Bacon	15	30	30	30	30	30	<i>Day 37.</i>						
Bread	150	150	150	150	150	150	Rice	200	200	200	200	175	200
Rice	200	200	150	150	150	150	Bacon	30	30	30	30	30	30
Bacon	30	30	30	30	0	30	Bread	75	150	135	150	135	150
Bread	0	100	150	75	0	150	Rice	350	350	310	350	350	350
<i>Day 31.</i>							Onions	150	150	150	150	150	75
Rice	300	300	300	300	300	300	Lard	20	20	20	20	20	10
Bananas	150	150	150	150	150	150	<i>Day 38.</i>						
Sugar	0	0	0	0	0	0	Rice	200	300	200	270	270	300
Rice	300	300	300	300	300	300	Bananas	100	100	100	100	100	100
Onions	100	100	100	100	100	100	Sugar	0	0	0	0	0	0
Lard	15	15	15	15	15	15	Rice	300	300	300	300	300	300
<i>Day 32.</i>							Bacon	50	50	50	50	50	50
Rice	200	200	200	200	200	200	<i>Day 39.</i>						
Bread	150	150	150	150	150	150	Rice	300	300	300	300	270	300
Bacon	30	30	30	30	30	30	Bacon	50	50	50	50	50	50
Rice	300	300	300	300	150	270	Rice	275	350	350	275	350	350
Bacon	50	50	50	50	50	50	Bread	0	0	0	0	0	0
<i>Day 33.</i>							Onions	150	0	150	0	0	150
Rice	300	300	300	300	300	260	Lard	20	0	20	0	0	20
Bacon	25	20	0	25	25	25	<i>Day 40.</i>						
Rice	No record.						Rice	200	200	200	200	0	200
Onions							Bread	50	150	135	150	150	150
Lard							Bacon	30	30	30	30	30	30
<i>Day 34.</i>							Rice	300	300	300	300	300	300
Rice	200	200	200	200	200	175	Bananas	150	150	150	150	150	150
Bread	75	150	150	150	150	150	Sugar	75	75	75	75	75	75
Bacon	30	0	30	30	30	30	<i>Day 41.</i>						
Rice	300	300	300	300	300	300	Rice	150	300	225	0	250	240
Bananas	150	150	150	150	150	150	Bananas	100	100	100	100	100	100
Sugar	0	0	0	0	0	0	Sugar	0	0	0	0	0	0
<i>Day 35.</i>							Rice	350	315	350	0	310	350
Rice	300	300	200	270	150	260	Onions	150	75	150	0	150	0
Bananas	100	100	100	100	100	100	Lard	20	10	20	0	20	0
Sugar	0	0	0	0	0	0	<i>Day 42.</i>						
Rice	350	350	350	350	350	350	Rice	300	300	260	300	250	300
Onions	150	150	150	150	150	150	Bacon	50	50	50	50	50	50
Lard	20	20	20	20	20	20							

TABLE V.—Record of rations consumed by prisoners of Group III—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	14	16	18	13	17	15		14	16	18	13	17	15
<i>Day 42—Ctd.</i>							<i>Day 49.</i>						
Rice	260	300	150	300	260	300	Rice	200	200	200	200	200	200
Bananas	150	150	150	150	150	150	Bread	150	150	150	150	150	150
Sugar	25	10	10	25	10	25	Bacon	30	30	30	30	30	30
<i>Day 43.</i>							Rice	290	350	175	350	315	350
Rice	200	200	200	160	200	200	Onions	0	150	0	0	75	50
Bread	0	110	150	150	150	150	Lard	0	20	0	0	10	5
Bacon	30	30	30	30	30	30	<i>Day 50.</i>						
Rice	350	350	225	225	350	350	Rice	300	300	300	300	300	300
Onions	75	150	0	75	110	110	Onions	50	100	0	50	0	100
<i>Day 44.</i>							Lard	10	15	0	10	0	15
Rice	300	300	40	270	250	300	Rice	300	300	300	300	300	300
Onions	100	100	30	30	75	100	Bananas	150	150	150	150	150	150
Lard	15	15	5	5	10	15	Sugar	25	25	25	25	25	25
Rice	300	300	0	300	240	300	<i>Day 51.</i>						
Bananas	150	150	0	150	150	150	Rice	300	300	300	300	300	300
Sugar	0	0	0	0	0	0	Bananas	100	100	100	100	100	100
<i>Day 45.</i>							Sugar	0	0	0	0	0	10
Rice	300	300	200	300	300	300	Rice	300	300	300	300	300	300
Bacon	50	50	0	50	50	50	Bacon	50	50	50	50	50	50
Rice	350	350	350	350	350	350	<i>Day 52.</i>						
Onions	150	150	150	150	150	150	Rice	300	300	300	300	300	300
Lard	20	20	20	20	20	20	Bacon	50	50	50	50	50	50
<i>Day 46.</i>							Rice	350	350	350	350	350	350
Rice	300	300	300	300	300	300	Onions	50	150	150	150	150	150
Bread	35	50	50	50	50	50	Lard	5	20	20	20	20	20
Bacon	30	30	0	30	30	30	<i>Day 53.</i>						
Rice	75	260	200	260	260	300	Rice	300	300	300	300	300	300
Bananas	100	150	0	150	150	100	Bread	75	75	75	75	150	75
Sugar	5	0	5	0	0	5	Bacon	30	30	30	30	30	30
<i>Day 47.</i>							Rice	300	300	300	150	300	300
Rice	150	300	300	150	250	200	Bananas	150	150	150	150	150	150
Bananas	100	100	100	100	100	100	<i>Day 54.</i>						
Sugar	0	0	0	0	0	0	Rice	300	300	300	300	300	300
Rice	300	300	300	300	300	300	Bananas	100	100	100	100	100	100
Bacon	50	50	50	50	50	50	Sugar	25	25	0	0	0	25
<i>Day 48.</i>							Rice	350	350	350	350	350	350
Rice	300	300	300	300	300	300	Onions	150	150	150	150	150	150
Bacon	50	50	50	50	50	50	Lard	20	20	20	20	20	20
<i>Day 49.</i>							<i>Day 55.</i>						
Rice	300	300	300	300	300	300	Rice	300	300	300	300	300	300
Bacon	50	50	50	50	50	50	Bacon	50	50	50	50	50	50
Rice	300	300	300	0	240	300	Rice	300	300	300	200	300	300
Bananas	150	150	150	0	150	150	Bananas	150	150	150	150	150	150
Sugar	0	0	0	0	0	0							

TABLE V.—Record of rations consumed by prisoners of Group III—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	14	16	18	13	17	15		14	16	18	13	17	15
<i>Day 56.</i>							<i>Day 63.</i>						
Rice	200	200	200	200	200	200	Rice	200	200	200	200	200	150
Bread	50	135	150	0	150	50	Bread	0	120	150	150	125	150
Bacon	30	30	30	30	30	30	Bacon	30	30	30	30	30	30
Rice	175	350	350	310	350	350	Rice	125	310	310	225	350	310
Onions	75	0	0	20	0	30	Onions	75	150	0	150	0	0
Lard	10	0	0	5	0	5	Lard	10	20	0	20	0	0
<i>Day 57.</i>							<i>Day 64.</i>						
Rice	260	300	300	300	300	300	Rice	300	250	260	300	300	300
Onions	50	100	50	100	50	100	Onions	50	25	0	15	0	50
Lard	10	15	10	15	10	15	Lard	10	5	0	5	0	10
Rice	300	300	300	300	300	300	Rice	300	300	300	300	300	300
Bananas	150	150	150	150	150	150	Bananas	50	150	150	150	150	150
<i>Day 58.</i>							Sugar	25	0	0	0	0	0
Rice	300	300	300	300	300	300	<i>Day 65.</i>						
Bananas	100	100	100	100	100	100	Rice	300	300	300	300	300	300
Rice	300	300	300	300	300	300	Bananas	100	100	100	100	100	100
Bacon	50	50	50	50	50	50	Sugar	0	0	5	0	25	0
<i>Day 59.</i>							Rice	300	300	300	300	300	300
Rice	300	300	300	300	300	300	Bacon	50	50	50	50	50	50
Bacon	50	50	50	50	50	50	<i>Day 66.</i>						
Rice	0	350	260	175	350	350	Rice	300	300	300	300	300	300
Onions	0	100	0	150	75	0	Onions	50	100	100	0	100	0
Lard	0	10	0	20	10	0	Lard	10	20	20	0	20	0
<i>Day 60.</i>							Rice	150	270	250	225	300	270
Rice	200	200	200	200	200	200	Bananas	150	150	150	150	150	150
Bread	0	110	150	150	150	100	Sugar	0	0	25	0	0	25
Bacon	30	30	30	30	30	30	<i>Day 67.</i>						
Rice	250	300	300	300	300	300	Rice	200	200	200	200	200	200
Bananas	150	150	150	150	150	150	Bread	0	150	150	150	150	150
Sugar	0	0	0	0	0	0	Bacon	30	30	30	30	30	30
<i>Day 61.</i>							Rice	350	350	310	350	350	350
Rice	300	300	300	300	300	240	Onions	75	0	0	0	0	150
Bananas	100	100	100	100	100	100	Lard	10	0	0	0	0	20
Sugar	0	0	25	0	25	25	<i>Day 68.</i>						
Rice	260	310	175	350	290	350	Rice	300	300	300	300	300	300
Onions	150	150	150	0	150	150	Bananas	150	150	150	150	150	150
Lard	20	20	20	0	20	20	Sugar	0	25	0	25	0	25
<i>Day 62.</i>							Rice	350	315	350	85	350	260
Rice	300	300	300	300	300	300	Onions	150	0	75	150	75	75
Bacon	50	50	50	50	50	50	Lard	20	0	10	20	10	10
Rice	270	300	300	300	300	300	<i>Day 69.</i>						
Bananas	150	150	150	150	150	150	Rice	300	250	300	300	300	300
							Bacon	50	50	50	50	50	50
							Rice	40	300	100	0	300	300

TABLE V.—Record of rations consumed by prisoners of Group III—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	14	16	18	13	17	15		14	16	18	13	17	15
<i>Day 69—Ctd.</i>							<i>Day 76—Ctd.</i>						
Bananas.....	150	150	150	0	150	150	Lard.....	15	15	15	0	10	5
Sugar.....	25	25	25	0	25	25	Rice.....	300	300	300	30	300	300
<i>Day 70.</i>							Bacon.....	50	50	50	50	50	50
Rice.....	300	300	300	0	300	270	<i>Day 77.</i>						
Onions.....	100	100	100	0	100	70	Rice.....	100	150	260	30	150	75
Lard.....	15	15	15	0	15	10	Bananas.....	100	100	100	50	100	100
Rice.....	300	300	270	300	300	300	Sugar.....	25	25	0	0	25	25
Bacon.....	50	50	50	50	50	50	Rice.....	150	225	260	0	50	100
<i>Day 71.</i>							Bacon.....	50	50	50	0	50	50
Rice.....	200	200	200	70	175	100	<i>Day 78.</i>						
Bread.....	0	50	150	0	150	100	Rice.....	200	200	200	200	260	260
Bacon.....	30	30	30	30	30	30	Bread.....	0	75	150	0	150	150
Rice.....	260	300	300	40	300	300	Bacon.....	30	30	30	30	30	30
Bananas.....	150	150	150	150	150	150	Rice.....	175	225	350	25	265	265
Sugar.....	25	25	25	25	25	25	Onions.....	150	150	25	150	25	25
<i>Day 72.</i>							Lard.....	20	20	5	20	5	5
Rice.....	260	300	300	0	300	300	<i>Day 79.</i>						
Bacon.....	50	50	50	50	50	50	Rice.....	300	250	260	25	300	250
Rice.....	310	260	225	175	350	310	Bacon.....	50	50	50	50	50	50
Onions.....	50	50	20	150	20	50	Rice.....	150	150	150	0	0	0
Lard.....	5	5	5	20	5	5	Bananas.....	150	150	150	150	150	150
<i>Day 73.</i>							<i>Day 80.</i>						
Rice.....	No record kept.						Rice.....	150	25	150	0	0	25
Bananas.....							Onions.....	0	0	0	0	0	0
Sugar.....							Rice.....	300	250	270	40	260	260
Rice.....							Bacon.....	50	50	50	50	50	50
Onions.....							<i>Day 81.</i>						
Lard.....							Rice.....	240	200	300	0	300	150
<i>Day 74.</i>							Bananas.....	100	100	100	50	100	100
Rice.....	175	150	70	0	150	175	Rice.....	260	175	45	45	45	0
Bread.....	0	100	150	0	150	100	Onions.....	20	75	0	0	0	0
Bacon.....	30	30	30	0	30	30	Lard.....	5	10	0	0	0	0
Rice.....	100	300	300	0	300	75	<i>Day 82.</i>						
Bananas.....	150	150	150	100	150	150	Rice.....	200	200	200	200	200	0
Sugar.....	25	25	25	25	25	25	Bread.....	150	150	150	150	150	150
<i>Day 75.</i>							Bacon.....	30	30	30	30	30	30
Rice.....	0	0	100	0	0	0	Rice.....	225	225	35	75	260	75
Bananas.....	100	0	0	100	0	0	Bacon.....	50	50	50	50	50	30
Sugar.....	0	0	0	25	0	0	<i>Day 83.</i>						
Rice.....	300	300	300	(a)	300	300	Rice.....	150	200	200	25	200	150
Bacon.....	50	50	50	(a)	50	50	Onions.....	0	0	0	0	0	0
<i>Day 76.</i>							Rice.....	75	50	30	30	75	50
Rice.....	300	150	300	0	100	75	Bananas.....	150	150	150	150	150	150
Onions.....	100	100	100	0	40	0	Sugar.....	0	0	0	0	0	0

^a Left with prisoner.

TABLE V.—Record of rations consumed by prisoners of Group III—Contd.

Diet.	Amount, in grams, consumed by prisoner number—						Diet.	Amount, in grams, consumed by prisoner number—					
	14	16	18	13	17	15		14	16	18	13	17	15
<i>Day 84.</i>							<i>Day 92.</i>						
Rice	300	300	300	300	250	300	Rice	300	300	300	300	300	300
Bacon	50	50	50	50	50	50	Bacon	50	50	50	50	50	50
Rice	85	0	85	25	45	0	Rice	85	220	85	85	25	85
Onions	0	0	0	0	0	0	Onions	0	20	150	150	0	20
<i>Day 85.</i>							<i>Day 93.</i>						
Rice	300	300	300	300	300	300	Rice	75	75	150	225	200	225
Bananas	100	100	100	100	100	100	Bananas	100	100	100	100	100	100
Rice	300	300	300	300	300	300	Sugar	0	0	0	0	0	0
Bacon	50	50	50	50	50	50	Rice	300	300	240	300	300	300
<i>Day 86.</i>							Bacon	50	50	50	50	50	50
Rice	200	150	150	200	175	25	<i>Day 94.</i>						
Bread	110	150	150	150	150	150	Rice	200	200	200	200	200	200
Bacon	30	30	30	30	30	30	Bread	0	50	135	150	150	135
Rice	0	0	125	0	290	125	Bacon	30	30	30	30	30	30
Onions	0	0	0	0	0	0	Rice	260	260	225	280	175	350
<i>Day 87.</i>							Onions	150	150	150	150	150	150
Rice	300	300	300	300	300	300	Lard	20	20	20	20	20	20
Bacon	50	50	50	50	50	50	<i>Day 95.</i>						
Rice	200	185	225	225	260	0	Rice	300	300	300	300	300	300
Bananas	150	150	150	150	150	150	Bacon	50	50	50	50	50	50
Sugar	25	25	0	0	25	0	Rice	300	300	300	300	300	300
<i>Day 88.</i>							Bananas	150	150	150	150	150	150
Rice	300	300	260	260	270	0	<i>Day 96.</i>						
Onions	100	100	100	100	100	0	Rice	200	150	300	150	200	150
Lard	15	15	15	15	15	0	Onions	0	0	0	0	0	0
Rice	300	300	300	300	300	260	Rice	0	150	0	0	150	0
Bacon	50	50	50	50	50	50	Bacon	50	50	50	50	50	50
<i>Day 89.</i>							<i>Day 97.</i>						
Rice	150	75	150	150	50	0	Rice	0	0	0	0	0	0
Bananas	100	100	100	100	100	100	Bananas	0	0	0	0	0	0
Rice	175	60	0	60	60	0	Rice	225	150	300	75	225	75
Onions	0	0	0	0	0	0	Fish	30	30	30	30	30	30
<i>Day 90.</i>							<i>Day 98.</i>						
Rice	200	200	200	200	200	200	Rice	(a)	300	240	300	300	250
Bread	75	150	150	150	75	150	Fish		30	30	30	30	30
Bacon	30	30	30	30	30	30	Rice		260	300	150	225	200
Rice	225	200	225	300	185	260	Potatoes		75	150	150	150	150
Bacon	50	50	50	50	50	50	Bacon		50	50	50	50	50
<i>Day 91.</i>							<i>Day 99.</i>						
Rice	300	300	240	260	300	300	Rice		75	225	0	200	0
Onions	100	100	100	100	100	100	Potatoes		20	20	0	150	0
Lard	15	15	15	15	15	15	Bacon		5	5	0	50	0
Rice	200	200	150	150	0	100	Rice		0	260	0	0	0
Bananas	150	150	150	150	150	150	Fish		0	30	0	0	0

^a Diet discontinued.

TABLE V.—*Record of rations consumed by prisoners of Group III—Contd.*

Diet.	Amount, in grams, consumed by prisoner number—					
	14	16	18	13	17	15
<i>Day 114.</i>						
Rice -----	150	300	300	225	225	
Potatoes -----	100	100	100	100	100	
Fish -----	30	30	30	30	30	
Rice -----	40	150	75	75	75	
Bananas -----	150	150	150	150	150	
<i>Day 115.</i>						
Rice -----	200	300	150	225	225	
Bacon -----	50	50	50	50	50	
Rice -----	185	75	150	150	150	
Fish -----	30	30	30	30	30	
<i>Day 116.</i>						
Rice -----	300	300	300	240	300	
Potatoes -----	100	100	100	100	100	

Diet.	Amount, in grams, consumed by prisoner number—					
	14	16	18	13	17	15
<i>Day 116—Ctd.</i>						
Bacon -----	30	30	30	30	30	
Rice -----	240	300	240	240	240	
Bananas -----	150	150	150	150	150	
Sugar -----	25	25	25	25	25	
<i>Day 117.</i>						
Rice -----	240	300	300	200	300	
Potatoes -----	100	100	100	100	100	
Fish -----	30	30	30	30	30	
Rice -----	300	300	300	300	300	
Bacon -----	50	50	50	50	50	
	End of experiment.					

GROUP IV.

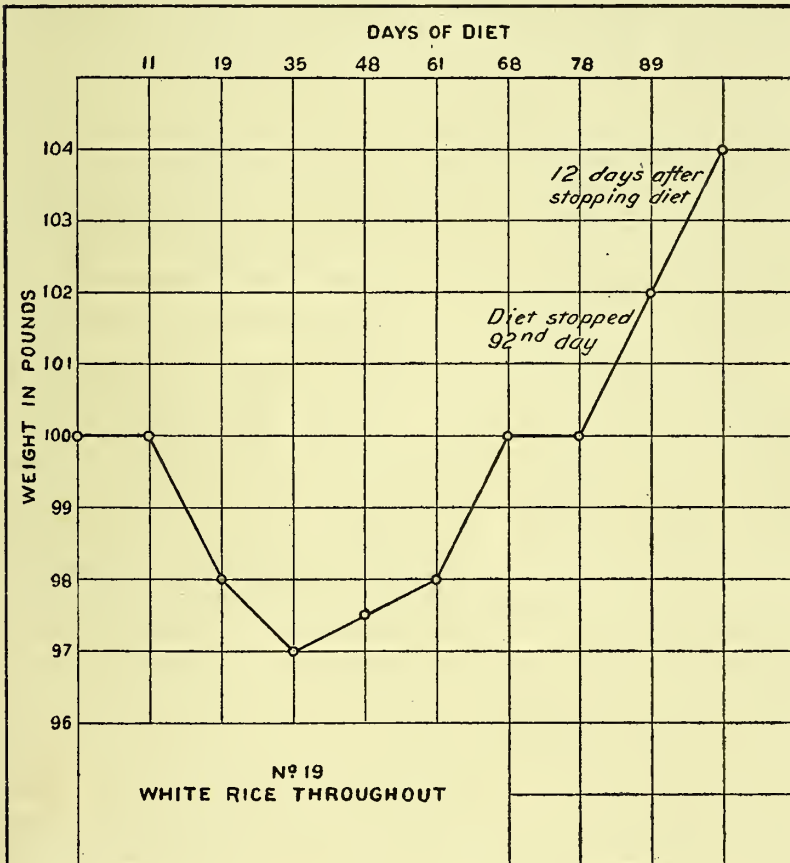
CASE NO. 19 (GROUP IV).

Diet: White rice for 92 days, together with the special diet common to all the groups. } Total period of experiment, 92 days.
Dried codfish and potatoes were added to the diet on the 81st day.

Following is a summary of the notes on the case: Sparely nourished man of small stature; examination of lungs reveals no abnormality. The area of cardiac dulness is not increased beyond the normal limits; the point of maximum impulse is palpable 7 centimeters to the left of the median line and 2 centimeters below the nipple line; the heart sounds are clear at the apex and base; there is no epigastric pulsation; the pulse is 80, and systolic blood pressure 115 millimeters Hg (Faught); the liver and spleen are not enlarged; the knee jerks are active.

The earlier notes of the case are unimportant. The patient lost 1.3 kilograms (3 pounds) in the first thirty-five days of the experiment. Then he began to gain and by the sixty-eighth day he had regained his original weight. The knee jerks remained active and he complained of no distress. On the sixty-ninth day the systolic blood pressure was 100 millimeters Hg. On the eighty-first day dried codfish and potatoes were added to the diet. On the eighty-third day the following note was made: Cardiac

pulsation visible in the second left interspace; the apex beat is diffuse but not visible outside the nipple; the area of dullness is not distinctly increased; both heart sounds are forcible and clear; the second pulmonic sound is accentuated; the pulse is 100; he complains of pain in the legs and in the arms; slight œdema of the legs has developed; the knee jerks are very weak. On the eighty-ninth day the following note was made: Slight œdema of the legs continues; there is no complaint of pain; the pulse is slow. On the ninetieth day the note reads: Knee jerks very weak; slight œdema of the legs and no tenderness. On the ninety-second day it became necessary to discontinue the diet. The note made on this date reads as follows: Fairly well nourished; pulse 88 before and 104 after slight exercise, of good volume, tension somewhat increased; epigastric pulsation visible; the point of maximum impulse is visible and palpable 7.5 centi-



meters to the left of the median line; slight cardiac impulse visible and palpable in the third and fourth interspaces; throbbing more marked near the apex; the heart sounds are very forcible after slight exertion; there are no distinct murmurs; he complains of pain in the legs and arms; the grip of the hands is feeble; there is slight tenderness of the calves and there is slight œdema over the tibiæ; the knee jerks are still present but very weak; the patient complains of tingling and numbness over the feet and legs; there is no distinct loss of sensation; the urine shows no albumin and no casts; he weighed 2 pounds (0.9 kilogram) more at the close of the experiment than at the beginning of it. He was placed on the regular prison diet, and in twelve days had gained 2 more pounds.

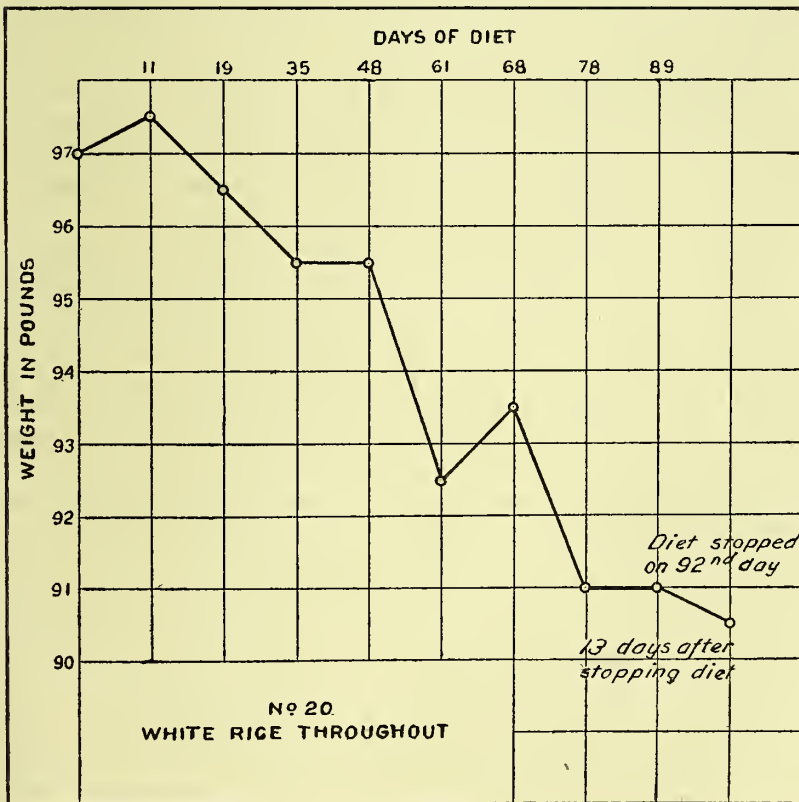
CASE NO. 20 (GROUP IV).

Diet: White rice for 92 days, together with the special diet common to all the groups.	}	Total period of experi- ment, 92 days.
Dried codfish and potatoes were added to the diet on the 81st day.		

Following is a summary of the notes of the case: Sparely nourished man of small stature; examination of the lungs reveals no abnormality; the area of cardiac dulness is not increased beyond the normal limits; the point of maximum impulse is visible and palpable 6 centimeters to the left of the median line and 0.5 centimeter below the nipple line; there is no epigastric pulsation; the pulse is 88; the systolic blood pressure is 100 millimeters Hg (Faught); the liver and spleen are not enlarged; the knee jerks are active.

The early notes of the case are unimportant except that he lost 2.2 kilograms (5 pounds) in weight during the first sixty-one days. The knee jerks remained active throughout this time. On the sixty-ninth day the systolic blood pressure was 90 millimeters Hg. On the eighty-first day dried codfish and potatoes were added to the diet. On the eighty-third day the following note was made: Epigastric pulsation marked; visible throbbing over the cardiac area; point of maximum impulse palpable 8 centimeters to the left of the median line; the cardiac dulness extends to the left 3 centimeters outside of the nipple, but is not increased to the right of the sternum; the second pulmonic sound is markedly accentuated at the base; there is a slight systolic murmur at the apex transmitted about halfway to the base; the pulse is 88; the heart sounds are occasionally irregular; he complains of pains and tenderness of the calves of the legs; there is no œdema of the legs and no areas of anæsthesia of the

skin; the knee jerks are active; he says he can not see well at night. On the eighty-ninth day the knee jerks were doubtful. There was no œdema of the legs, but the calves were tender on pressure; the pulse was 108. On the ninetieth day the knee jerks were absent; there was still no œdema, but there was marked tenderness of the calves of the legs. On the ninety-second day it became necessary to discontinue the diet and to return him to the regular prison ration. On this date the following note was made: Fairly well nourished; pulse 108, of good volume; the point of maximum impulse is visible and palpable 8 centimeters to the left of the median line; the first sound is still considerably prolonged at the apex; the second pulmonic and second aortic sounds are accentuated; there is moderate epigastric and cardiac pulsation; he complains of pain in the chest and in the stomach; the pain and tenderness in the legs still persist; there is no œdema of the legs; the knee jerks are still absent; the urine contains no albumin nor casts; the patient



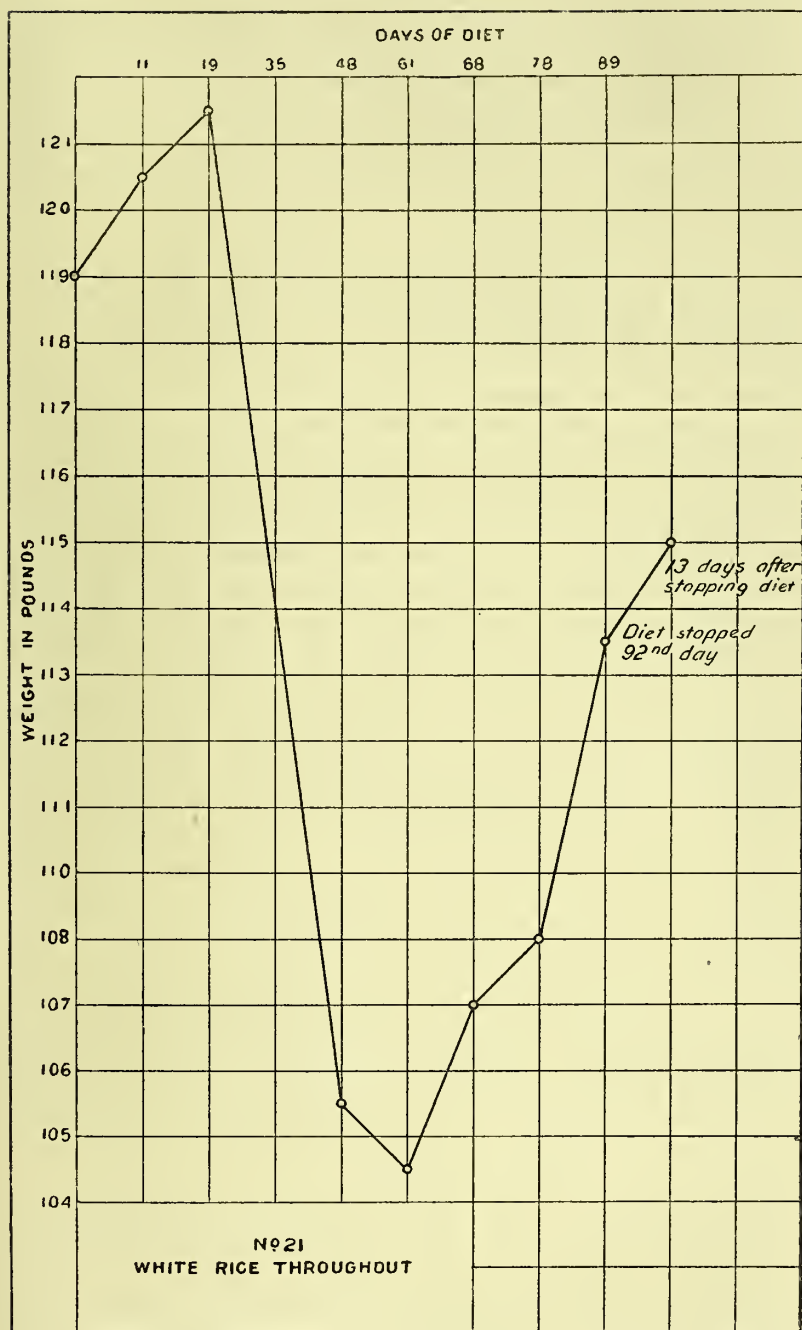
lost 2.7 kilograms (6 pounds) during the experiment; he had not gained any in weight during the first thirteen days after he received the regular prison ration.

CASE NO. 21 (GROUP IV).

Diet: White rice for 92 days, in addition to the special diet common to all the groups.	}	Total period of experi- ment, 92 days.
Dried codfish and potatoes were added to the diet on the 81st day.		

Following is a summary of the notes of the case: Fairly well-nourished man; percussion and auscultation of the lungs reveal no abnormality; examination of the heart shows no increase in the area of cardiac dulness beyond the normal limits; the point of maximum impulse is invisible; it is palpable 8 centimeters to the left of the median line and 1 centimeter below the nipple line; the first sound is slightly prolonged at the apex; both sounds are clear at the base; no epigastric pulsation is visible; the pulse is 76, and the systolic blood pressure 160 millimeters Hg (Faught); the liver is not palpable below the costal margin, and the dulness is not increased; the edge of the spleen is just palpable; the knee jerks are active.

The earlier notes of the case are otherwise unimportant. The patient gained 1.1 kilograms (2.5 pounds) during the first 19 days of the experiment. He then gradually lost in weight and by the forty-eighth day had lost 7.2 kilograms (16 pounds). On the sixty-ninth day the systolic blood pressure was 110 millimeters Hg. On the eighty-first day dried codfish and potatoes were added to the diet. On the eighty-third day the note shows that there was marked epigastric pulsation but no throbbing over the cardiac area; the point of maximum impulse was palpable 8.5 centimeters to the left of the median line; there was a soft systolic murmur at the apex not transmitted to the base; the second pulmonic sound was distinctly accentuated; the pulse was 80 before and 88 after slight exercise; there was slight oedema of the legs; some pain in the calves was complained of; the knee jerks were very active; the patient gained in weight since the sixty-first day, in all 3.6 kilograms (8 pounds). On the eighty-ninth day the note reads: Pulse slow; no complaint of pain; the knee jerks are very active; there is marked oedema of the legs; the urine contains no albumin nor casts. On the ninety-first day the knee jerks were very active; the legs were oedematous; there was no tenderness of the calves and no areas of anæsthesia of the skin of the feet and hands; he was still fairly well nourished; the pulse was 84; there was slight



epigastric pulsation but no cardiac throbbing; the point of maximum impulse was not distinctly visible nor palpable; there were no murmurs; he complained of pain from his waist down; the legs were distinctly œdematous; there was slight tenderness of the calves; the knee jerks were active; the urine contained no albumin nor casts. It became necessary to change to the regular prison diet two days later.

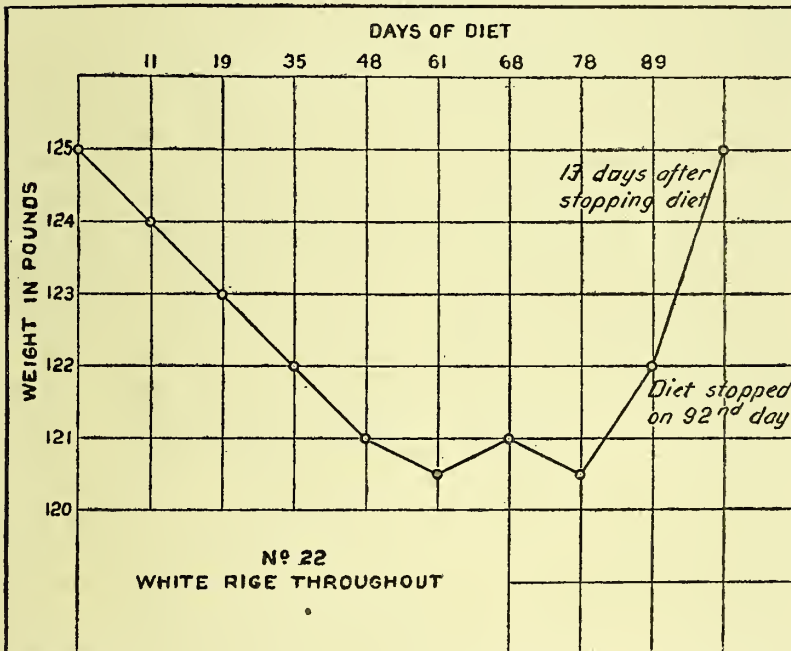
CASE NO. 22 (GROUP IV).

Diet: White rice 92 days, together with the	}	Total period of experiment, 92 days.
special diet common to all the groups.		
Dried codfish and potatoes were added to the diet on the 81st day.		

Following is a summary of the notes of the case: Sparely nourished man; percussion of the lungs shows no distinct area of dulness; the respiratory sounds are somewhat enfeebled at the apices; there is no tubular modification and no râles are present; the area of cardiac dulness is not increased beyond the normal limits; the point of maximum impulse is not visible nor palpable; the sounds are clear at the apex and base; there is no epigastric pulsation; the pulse is 72, and the systolic blood pressure 120 millimeters Hg (Faught); the abdomen is prominent. The liver and spleen are not enlarged; the knee jerks are active.

The earlier notes of the case are otherwise not important. The patient lost but 1.8 kilograms (4 pounds) in weight during the first sixty-one days of the experiment. The knee jerks remained active. On the sixty-eighth day the systolic blood pressure was 110 millimeters Hg. On the seventy-second day he complained of soreness of the throat. There was nothing apparent to account for the complaint, though he continued to complain of this symptom during the following days. On the eighty-first day dried codfish and potatoes were added to the diet. On the eighty-third day he complained of no pain except in the throat after eating. The heart sounds were clear; the cardiac dulness was apparently not changed; there was no throbbing over the cardiac area, and but slight epigastric pulsation; the pulse was 70; there was marked œdema of the legs, but no tenderness; the knee jerks were very active. On the eighty-eighth day the pulse was 72. There was no complaint of pain, but the throat was still sore; there was marked œdema of the legs, but the knee jerks were active. On the ninetieth day the knee jerks were still active. The marked œdema of the legs continued; there was no tenderness of the calves. On the ninety-second day it became necessary to discontinue the diet. The

following note was made on this date: Fairly well nourished; the conjunctivæ are of very good color; the abdomen is prominent; the pulse is slow and full; he complains of pain over the abdomen; there is a little tenderness on pressure over the abdominal wall; there is very slight epigastric pulsation; the point of maximum impulse is not visible nor palpable; the heart sounds are clear; the area of dulness is not increased; the knee jerks are very active; there is very marked œdema of the legs and some tenderness of the calves; the respirations are 20; he complains of pain from the waist down to the feet, and says he feels very ill; there is apparently no fluid in the abdominal



cavity; the urine contains no albumin nor casts. The patient had lost but 1.3 kilograms (3 pounds) in weight during the course of the experiment.

CASE NO. 23 (GROUP IV).

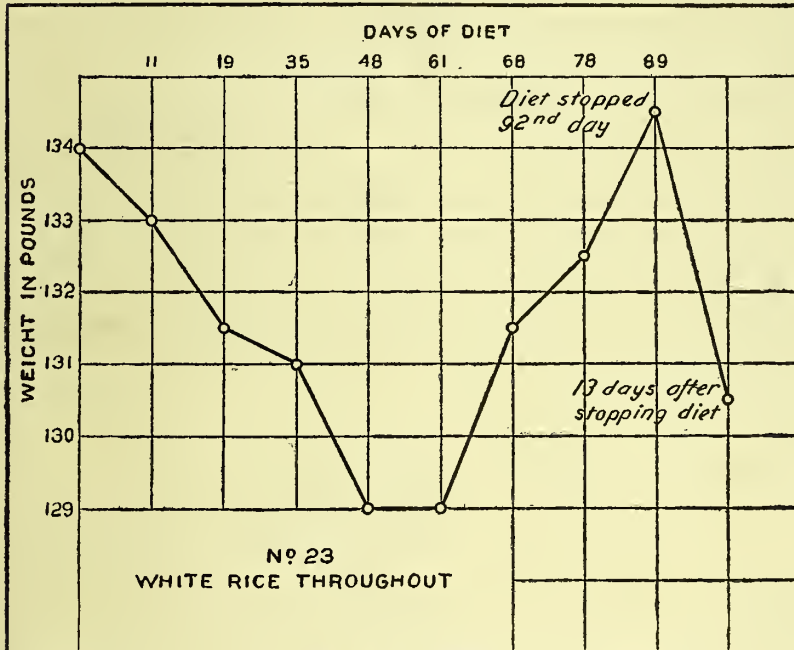
Diet: White rice 92 days, together with the } Total period of experi-
special diet common to all the groups. } ment, 92 days.
Dried codfish and potatoes were added to the diet on the 81st day.

Following is a summary of the notes of the case: Well-nourished man; examination of the lungs reveals nothing abnormal;

examination of the heart shows the area of dulness not increased beyond the normal limits; the point of maximum impulse is invisible; it is palpable 7 centimeters to the left of the median line and 1.5 centimeters below the nipple line; the mamma moves very slightly with the systole of the heart; the heart sounds are somewhat rapid but clear; the pulse is 98; the systolic blood pressure is 120 millimeters Hg. The liver and spleen are not palpable below the costal margin. The knee jerks are active.

The earlier notes of this case are otherwise not important; the patient had lost 5 pounds by the forty-eighth day of the experiment; the knee jerks remained active. On the sixty-ninth day the systolic blood pressure was 120 millimeters Hg. On the eighty-first day dried codfish and potatoes were added to the diet. On the eighty-third day the note reads: Visible throbbing over the cardiac area from the third interspace and sternum downward to below the nipple and outward 1 centimeter beyond the nipple; the point of maximum impulse is 9 centimeters to the left of the median line; the area of dulness extends 2.5 centimeters to the left of the nipple line, a slight distinct increase; there is slight epigastric pulsation; a soft systolic murmur is heard at the apex, but is not transmitted to the base; the second pulmonic sound is moderately accentuated; there is visible pulsation of the vessels of the neck; the respirations are 24, the pulse 104 before and 124 after slight exertion; he complains of pain in the calves of the legs, and there is marked œdema of the legs; the knee jerks are active. On the eighty-fourth day the pulse was 110 and of full volume. On the eighty-fifth day the note reads: Pulse 96; complains still of pains in the legs; there is marked œdema; the knee jerks are active; the urine contains no albumin nor casts. On the eighty-eighth day the pulse was 92. There were no pains in the legs this date, but some œdema was present. The knee jerks were active. On the ninetyieth day the knee jerks were very active. The œdema of the legs continued. There was no hyperæsthesia of the calves of the legs. On the ninety-second day it became necessary to discontinue the diet. The following note was made on that date: Pulse 92 and of good volume. Well-nourished individual. Cardiac pulsation visible; extends to the left as far as the nipple line, and distinctly 1.5 centimeters outside the nipple line. Point of maximum impulse 9.75 centimeters to the left of the median line. Dulness extends to the left 3.5 centimeters outside the nipple. The first sound is roughened and prolonged at the

apex. There is no complaint of pain in the legs, and the calves are not tender on being pressed. No areas of anæsthesia of the skin can be discovered. There is some œdema of the legs. The knee jerks are exaggerated. The urine contains no albumin nor casts. The patient gained 2.2 kilograms (5 pounds) in weight from the sixty-first to the eighty-ninth days of the experiment, when he had reached his original weight. Thirteen days after resuming the ordinary prison ration he had again lost 5.5 pounds.



CASE NO. 24 (GROUP IV).

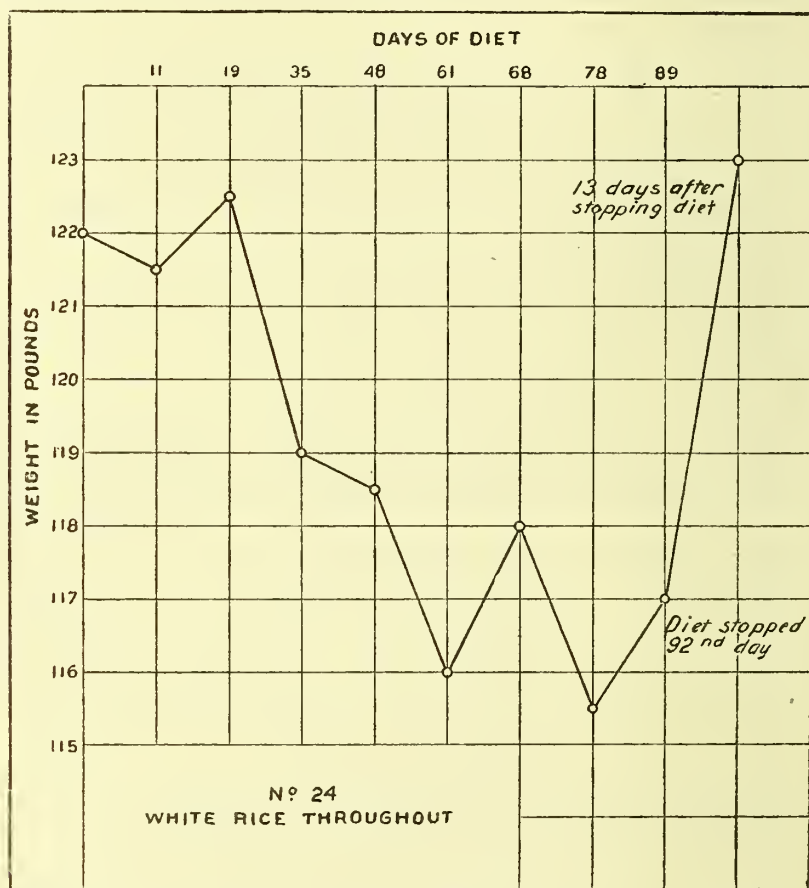
Diet: White rice 92 days, together with the } Total period of experiment, 92 days.
special diet common to all the groups. }

Dried codfish and potatoes were added to the diet on the 81st day.

The following is a summary of the notes of the case: Fairly well-nourished man; percussion of the lungs shows no abnormal dulness; the respiratory sounds are normal; examination of the heart shows no increase in the area of dulness beyond the normal; the point of maximum impulse is visible and palpable 8 centimeters to the left of the median and 3 centimeters below the nipple line; the heart occasionally intermits a beat; the first sound at the apex is roughened; the second aortic sound is

slightly accentuated; there is no visible pulsation over the epigastrium; the pulse is 76, and the systolic blood pressure 128 millimeters Hg (Faught); the liver and spleen are not enlarged; the knee jerks are active.

The earlier notes of the case show otherwise nothing of importance except that the patient lost 2.7 kilograms (6 pounds) in weight by the sixty-first day. On the sixty-ninth day the



systolic blood pressure was 105 millimeters Hg. On the eighty-first day dried codfish and potatoes were added to the diet. On the eighty-third day the note reads: Complains of no pain, but of general weakness; has lost 2.7 kilograms (6 pounds) in weight; there is epigastric pulsation, but no visible throbbing over the cardiac area; the point of maximum impulse is 8.5

centimeters to the left of the median line; the area of dulness is not distinctly increased either to the right or to the left; the first sound at the apex is prolonged, the second aortic markedly accentuated; there is no reduplication of the sounds; the pulse is 90; there is no œdema of the legs and no pain in the calves; the knee jerks are active. On the eighty-ninth day the note shows that there was no apparent change in his condition. The knee jerks were active. There was no œdema and no pain in the legs. The pulse was slow. He had gained 0.68 kilogram (1.5 pounds) in weight. His condition remained about the same until it became necessary to discontinue the diet on the ninety-second day of the experiment. On this day the following note was made: Nutrition good; abdomen prominent; pulse 80; very slight epigastric pulsation; no visible pulsation over the cardiac area; point of maximum impulse not visible; palpable 7.5 centimeters to the left of the median line; there is no tenderness of the calves and no œdema of the legs; the knee jerks are active; he states that he feels a little weaker than when he began the diet; the urine was normal. Thirteen days after resuming the regular prison ration he had gained 2.7 kilograms (6 pounds) and stood at the same weight as at the time the experiment was commenced.

CASE NO. 25 (GROUP IV).

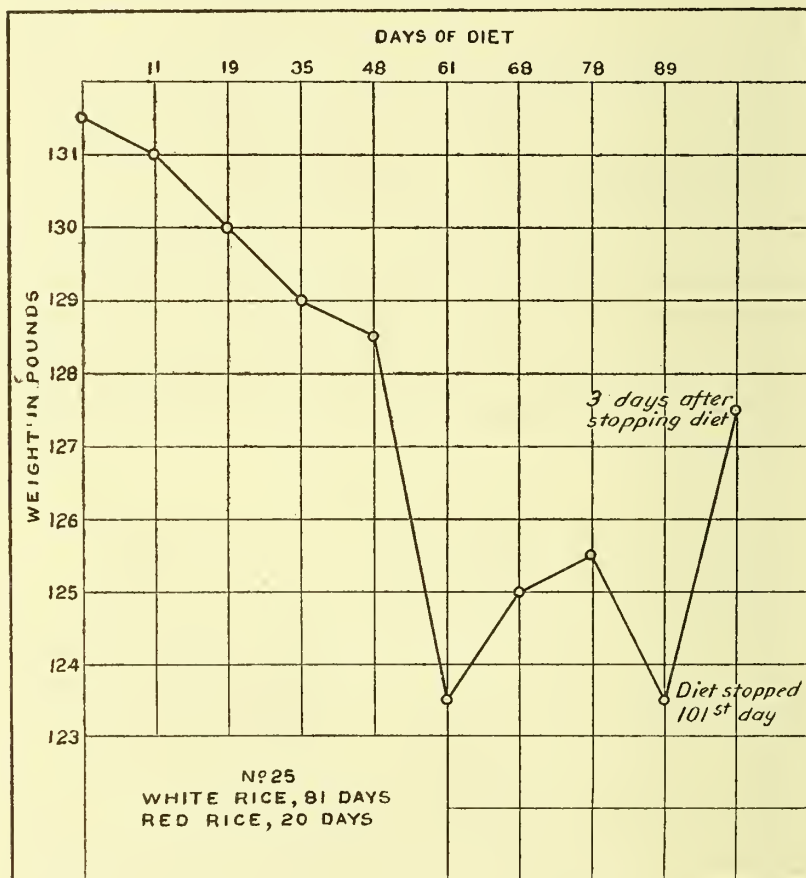
Diet: White rice for 81 days followed by red rice for 20 days, in addition to the special diet common to all the groups.	}	Total period of experi- ment, 101 days.
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Dried codfish and potatoes were added to the diet on the 81st day.

Following is a summary of the notes of the case: Well-nourished man; examination of the lungs reveals nothing abnormal; the examination of the heart shows no increase in the area of cardiac dulness beyond the normal; the point of maximum impulse is invisible; it is palpable 7.5 centimeters to the left of the median line and 1.5 centimeters below the nipple line; the heart sounds are clear at the apex and base; there is no epigastric pulsation; the pulse is 76, and the systolic blood pressure 100 millimeters Hg (Faught); the spleen is not palpable; the liver flatness extends from the lower border of the fourth rib; the liver is not palpable below the costal margin; the knee jerks are active.

The earlier notes concerning the case contained nothing of importance, except that the patient lost in weight and by the sixty-first day weighed 3.6 kilograms (8 pounds) less than when

he began the experiment. On the sixty-third day the knee jerks could no longer be obtained. There was no œdema of the legs. The cardiac impulse could be seen after slight exertion. The heart sounds remained clear; there was no murmur. The subsequent notes show that the knee jerks remained absent. On the sixty-ninth day the systolic blood pressure was 80 millimeters Hg. On the seventy-fifth day the following note was made:



Pulse 96; complains of pain in the calves of the legs; no œdema of legs; knee jerks not elicited. No change in the condition of the heart. On the seventy-eighth day, marked weakness of the legs and difficulty in walking; knee jerks not elicited; no œdema of legs; pulse 100. On the seventy-ninth day the note reads: Pulse 84; knee jerks absent; complains of pain and weakness in

the calves of the legs. On the eighty-first day, the knee jerks were still absent. Slight œdema of the legs had appeared. There was marked hyperæsthesia of the muscles of the calves of the legs. The patient said he felt weak in his legs. The gait was not ataxic. The condition of the heart was not distinctly changed. Red rice was substituted for white rice in the diet on this date, and dried codfish and potatoes were also added. On the eighty-second day the pulse was 120. The pains in the calves of the legs and tenderness on pressure continued. There were no distinct areas of anæsthesia of the skin. There was slight prætibial pitting on pressure over the ankles. On the eighty-third day the note reads: Visible throbbing over the cardiac area; no distinct increase in the area of dulness; the heart sounds are clear; the first sound is short; the œdema of the legs has almost disappeared; the pulse is 100. On the eighty-ninth day it was noted that the strength of the legs was gradually returning. On the one hundred first day the diet was discontinued. The note at the end of the experiment reads: Pulse 88, regular; fairly well nourished; no epigastric nor præcordial pulsation; the point of maximum impulse is not visible nor distinctly palpable; the heart sounds are clear; the area of dulness extends to about 1.5 to 2 centimeters to the left of the nipple line and just to the right edge of the sternum; there is no definite increase since the beginning of the experiment; the pain, tenderness, and weakness in the legs are still present; there is no œdema of the legs; the knee jerks are still absent; the urine contains no albumin nor casts. Three days after resuming the regular prison ration he had gained 1.8 kilograms (4 pounds).

CASE NO. 26 (GROUP IV).

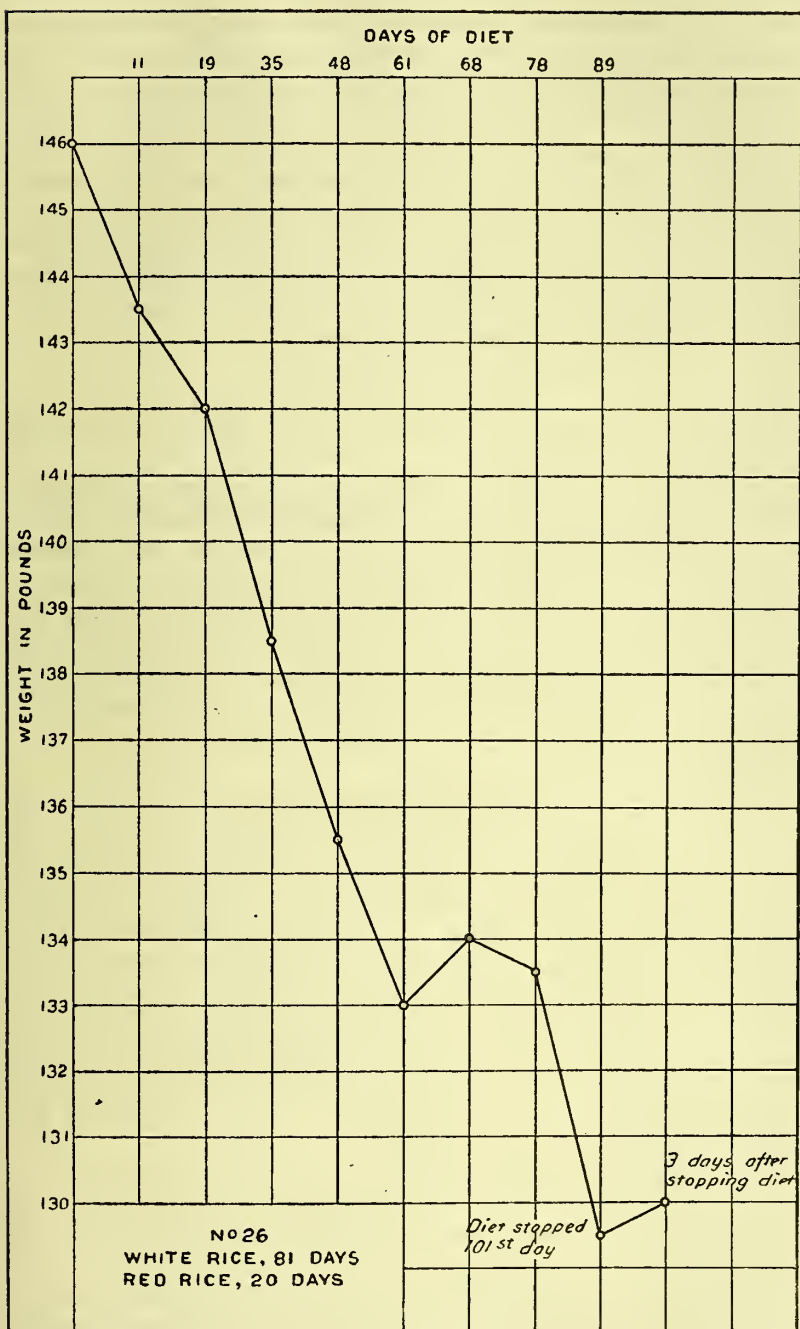
Diet: White rice for 81 days followed by red rice for 20 days, together with the special diet common to all the groups.	}	Total period of experiment, 101 days.
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Dried codfish and potatoes were added to the diet on the 81st day.

Following is a summary of the notes of the case: Well-nourished man; auscultation and percussion of the lungs reveal nothing abnormal; the examination of the heart shows that the area of cardiac dulness is not increased beyond the normal limits; the point of maximum impulse is visible and not distinctly palpable; both sounds are clear at the apex; the second aortic sound is a little muffled, but there is no murmur; there is no epigastric pulsation; the pulse is 88 and the systolic blood pres-

sure is 108 millimeters Hg (Faught); the spleen is not palpable; the liver dulness begins at the lower border of the fifth rib; the edge is palpable just below the costal margin; the knee jerks are active.

The earlier notes of this case are not important except that the patient steadily lost in weight and by the sixty-third day of the experiment he weighed 5.8 kilograms (13 pounds) less than when he began the diet. The note made on this date reads as follows: Apex beat not visible nor distinctly palpable; pulse 86; no change in the condition of the heart apparent; the knee jerks are present but are weak. There was no change in his condition for the next few days. On the sixty-ninth day the systolic blood pressure was 90 millimeters Hg; he complained on this date of sharp pains in his fingers: From the sixty-ninth to the seventy-fifth day he continued to complain of pain in the ends of his fingers. On the latter day the pulse was 84 and he also complained of tenderness in his toes. On the seventy-sixth day the following note was made: There is marked weakness of the hands which are held semiflexed, and the grip of the hands is weak; the pulse is 100; the knee jerks are not elicited; there is no change in the heart sounds; there is slight epigastric but no præcordial pulsation and no œdema of the legs; there is hyperæsthesia of the skin of the fingers and toes and ankles; the patient winces when pressure is made over the calves of the legs. On the seventy-eighth day the note reads as follows: Pulse 78; patient in bed and not eating—complains of pains in the legs and arms; knee jerks not elicited; there is no œdema of the legs; the power in the hands is very weak. On the seventy-ninth day he was up and walking about; the pulse was 76; the gait was a little unsteady but not ataxic, though his body swayed when he stood with his eyes closed; the heart sounds were clear; there was no visible pulsation over the cardiac area; the hands were held semiflexed but could be extended; there was no wrist drop. On the eighty-first day it became necessary to substitute red rice for white rice, and on the following day dried codfish and potatoes were added to the diet. On the eighty-second day the note reads: The grip of the hands seems stronger but he still complains of pains in the fingers, legs, and toes. On the eighty-third the point of maximum impulse is not visible; the heart sounds are rapid and clear at the apex and feeble at the base; there is marked visible pulsation over the cardiac area; the pulse is 100; there is no distinct increase in the area of cardiac dulness. On the eighty-ninth day the strength of the hands seemed to continue to



increase. On the one hundred first day the diet was discontinued and the patient returned to the regular prison ration. On the following day the note reads: Nutrition fair; slight epigastric but no præcordial pulsation visible; point of maximum impulse not visible nor palpable; pulse 100; heart sounds clear at apex and feeble at base; there is no increase in the cardiac dulness; some tenderness in the calves of the legs is still present; the knee jerks are still present; there is no œdema of the legs; the fingers and toes are still weak. The urine showed no albumin and no casts. The patient gradually recovered. He had lost 7.7 kilograms (17 pounds) during the experiment.

CASE NO. 27 (GROUP IV).

Diet: White rice 82 days, together with the special diet common to all the groups.

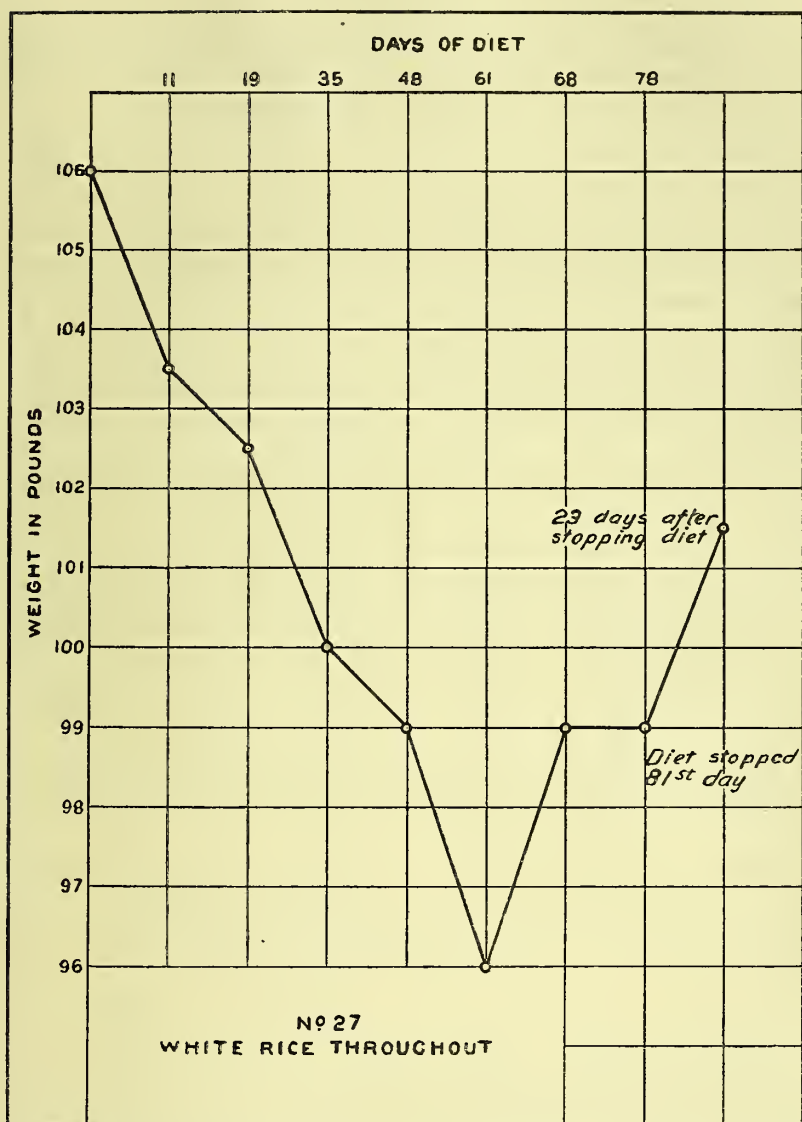
Following is a summary of the notes of the case: Well-nourished man of small stature; examination of the lungs shows nothing abnormal; the area of cardiac dulness is not increased beyond the normal limits; the point of maximum impulse is visible and palpable 6.5 centimeters to the left of the median line and 2.5 centimeters below the nipple line; the heart sounds are clear at the apex and base; there is no epigastric pulsation; the pulse is 96, and the systolic blood pressure 120 millimeters Hg (Faught); the spleen and liver are not enlarged; the knee jerks are active.

The earlier notes of this case are also not important. The patient lost steadily in weight until he weighed 10 pounds less than when he began the experiment. The knee jerks were always present. On the sixty-ninth day the systolic blood pressure was 120 millimeters Hg. No change had been noted in the condition of the heart. On the eighty-second day it became necessary to discontinue the diet. At this time he was in good condition. No change had occurred in the condition of the heart, and no symptoms of beriberi had developed during the course of the experiment. The urine showed no albumin nor casts. Twenty-three days after his return to prison ration he had gained 1.1 kilograms (2.5 pounds).

CASE NO. 28 (GROUP IV).

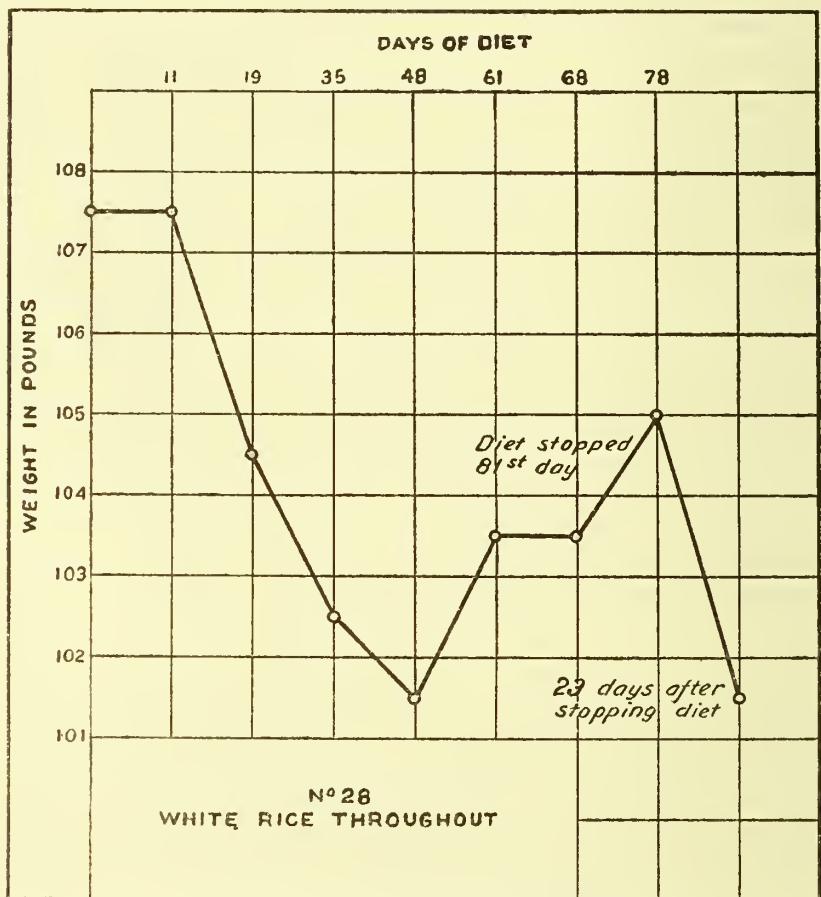
Diet: White rice for 82 days, together with the special diet common to all the groups.

Following is a summary of the notes of the case: Sparely nourished man; examination of the lungs reveals no abnormality; examination of the heart shows no increase of cardiac dulness



beyond the normal limits; the point of maximum impulse is just visible and palpable 7 centimeters to the left of the median line and 2 centimeters below the nipple; the heart sounds are clear at the apex and base; there is no epigastric pulsation visible; the pulse is 72, and the systolic blood pressure 100 millimeters Hg; the liver and spleen are not palpable below the costal margin; the knee jerks are active.

The other notes regarding this case are not important, except that the patient lost gradually in weight until the forty-eighth day of the experiment, 2.7 kilograms (6 pounds) in all. He then began to gain, and on the seventy-eighth day had regained 1.5 kilograms (3.5 pounds). The notes from the sixty-third to the sixty-eighth day show the knee jerks to have been very active. They were not lost throughout the time of the experiment. On the sixty-ninth day the systolic blood pressure was 98 millimeters Hg. There was no important change in his condition from now on. On the eighty-second day it became necessary to discontinue the diet, and he was returned to the regular prison ration. At this time he was in good condition. No changes had occurred in the condition of the heart, and no symptoms of beriberi had developed. The urine showed no albumin nor casts. Twenty-

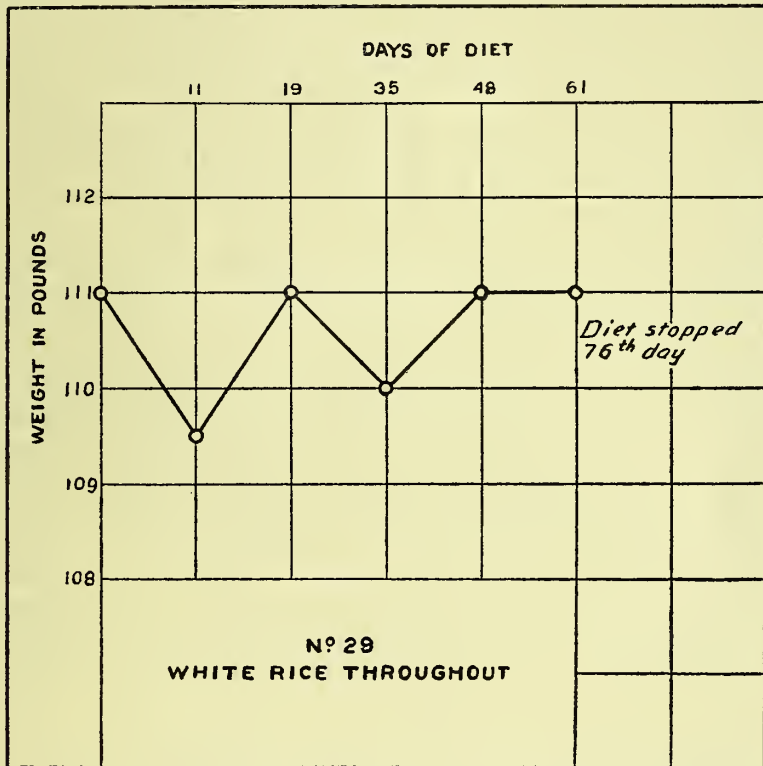


three days after resuming the regular prison ration he had lost again 1.5 kilograms (3.5 pounds).

CASE NO. 29 (GROUP IV).

Diet: White rice for 75 days, together with the special diet common to all the groups.

Following is a summary of the notes of the case: Sparely nourished man, moderately small in stature; percussion of the lungs reveals no area of dulness; on auscultation there is slight



roughening of the breath sounds over the right lung posteriorly near the base, but no tubular modification of the breath sounds and no râles; the area of cardiac dulness is not increased; the point of maximum impulse is neither visible nor palpable; there is no visible epigastric pulsation; the pulse is 104, and the systolic blood pressure 118 millimeters Hg (Faught); the liver and spleen are not enlarged; the knee jerks are active.

The earlier notes of the case are not important. The patient did not lose in weight. On the fifty-sixth day he complained of

swelling and pain in both legs. There was no particular pain on pressure over the calves. The right knee jerk was exaggerated, but the left seemed slightly diminished. The pulse was 104. On the sixty-first day the note reads as follows: Point of maximum impulse of the heart distinctly visible 10 centimeters to the left of the median line; no visible pulsation of the vessels of the neck; the heart sounds are clear at the apex and base. There is no tenderness of the calf muscles; the œdema of the legs has disappeared. The knee jerks are active. On the sixty-second day it was noted that the impulse over the cardiac area was not so marked. On the sixty-third day the note reads: Impulse just visible 10 centimeters from the middle line 5 centimeters below the nipple. Pulse 110 after exercise. Knee jerks active. On the sixty-fourth day œdema of the legs again appeared. On the sixty-fifth day the note made was as follows: Complains of pain in the chest, abdomen, and neck; pulse 120; epigastric and præcordial pulsation visible; there is marked œdema of both legs; the knee jerks are active. On the sixty-seventh day at noon the note was as follows: Not eating; pulse 96; respirations increased; marked præcordial and epigastric pulsation. He complains of weakness and epigastric pain. At 4 p. m. the pulse was 100; the respirations 40; and the epigastric pulsation marked. He ate but little. On the sixty-eighth day the knee jerks were still active, but he complained particularly of pain in the abdomen and legs. On the sixty-ninth day he complained of pain over the abdomen and in the thighs. There was marked epigastric pulsation, and the pulse was 106, full, and bounding. The knee jerks were active. There was still œdema of the legs. On the seventieth day the systolic blood pressure was 100 millimeters Hg. On account of the general condition of this patient, he was sent to the prison hospital. On the seventy-first day the pulse was 100, the knee jerks were active, the patient appeared drowsy. On the seventy-second day at noon the following note was made: Complains of feeling sore all over the body, and there is marked hyperæsthesia of the muscles of the calves; he is very drowsy; the face is puffy; there is marked œdema of the legs; the point of maximum impulse is not distinctly visible; it is palpable about 2 centimeters outside the nipple line and 4 centimeters below the nipple. On the seventy-third day the pulse was 104, and the knee jerks doubtful. He was still drowsy. On the seventy-fourth day the pulse was 120, respirations 24. He complained of pain in the chest and in the muscles of the legs and arms. There was slight epigastric

pulsation but no præcordial throbbing was visible. The knee jerks could not be elicited. On the seventy-fifth day the note made was as follows: Pulse 120; respirations 50; point of maximum impulse visible outside the nipple line; area of cardiac dulness increased transversely; there is slight præcordial pulsation; at the apex the first sound is short, and the spacing between the sounds equal; there are no definite murmurs, and no accentuation of the sounds at the base; there is marked dyspnœa, and the legs are œdematous; the knee jerks are absent. He complains of pain and tenderness over the chest and in the shoulders, neck, and calves of the legs. At 4 p. m. the pulse was 120, respirations 40, and the pulse very weak. The patient was placed on a general nourishing diet, and stimulation started. On the seventy-sixth day the pulse was very weak. The patient was very drowsy and responded slightly when spoken to. He was only semiconscious. The heart sounds were rapid and evenly spaced. On the seventy-seventh day the note was made as follows: Still weaker; there is marked general twitching of the muscles all over the body and some coarse tremors of the muscles of the shoulders; there is marked general œdema and general tenderness; no ascites; the pulse is very rapid and very weak; respirations 40; the temperature has been practically normal since he entered the hospital. The patient gradually sank and died at 2 p. m. on the following day. The urine in this case was greatly diminished in amount. On April 13, six days before his death, the amount for twenty-four hours was only 360 cubic centimeters, and the amount diminished each day until the day before his death, when only 60 cubic centimeters were passed. The specific gravity during this time varied between 1022 and increased gradually so that the day before death it was 1030. The urine contained no albumin at any time and no casts.

NECROPSY. ONE-HALF HOUR AFTER DEATH.

Anatomical diagnosis.—Acute beriberi; degeneration of heart muscle; epicardial, pleural, peritoneal, renal, hepatic, gastric, and duodenal ecchymoses; congestion and œdema of lungs; acute gastro-duodenitis; acute parenchymatous degeneration of kidney; acute congestion and degeneration of liver; pial œdema; hydrothorax; anasarca.

The cadaver is that of an adult male Filipino of about 40 years of age, measuring about 150 centimeters in length. The body is still warm. There is marked general subcutaneous œdema which is most marked over the legs, scrotum, and face. Hair of the head abundant, black, and straight. Beard moderate. Scant axillary and thoracic hair. Pubic hair of the male Caucasian type. No scars found on the body. Pupils are equal,

dilated, circular; corneæ and conjunctivæ clear. Ears, nose, and mouth normal. Superficial lymphatic glands not enlarged. Thorax broad and short; abdomen tense, but not distended. Rigor mortis not present. No post-mortem hypostases.

On section the rather abundant and yellow subcutaneous adipose is very moist, a clear fluid exuding from all cut surfaces. The skeletal muscles are pale, soft, friable, and moist. The abdominal cavity contains only a small amount of clear fluid in the fossæ, the peritoneum being everywhere smooth and glistening, without adhesions. The intestines are somewhat distended, their serosa pale. Liver reaches 2 centimeters below the right costal margin and 6 centimeters below the xyphoid. The dome of the diaphragm stands at the upper margin of the 5th rib on the right and the lower border of the 6th on the left.

Thorax.—On removal of the sternum the tissues of the anterior mediastinum are found to be somewhat œdematous. Both lungs are retracted beyond the cut costal margin, exposing a very large præcordial area. Each pleural sac contains about 200 cubic centimeters of clear yellowish fluid. The thymic pad is moist and fatty without recognizable glandular remnant.

Heart.—The præcordial area is large and the pericardium very tense. Before opening the pericardium, the apex is felt impinging upon the parietal pleura in the midaxillary line at the 6th rib, and the right border of the pericardium is 2.5 centimeters to the right of the sternal margin. On opening the pericardium, its inner wall is found smooth, and not more than about 30 cubic centimeters of clear fluid is found in its sac, the heart filling up and distending the sac. Both ventricles present anteriorly, the right a little more than the left, and the distension of the right heart (both auricle and ventricle) is the more marked. The right edge of the heart is very much rounded. In the right auriculo-ventricular groove anteriorly are a few small punctate epicardial ecchymoses. The apex is formed by both ventricles with a groove between them. Epicardial fat is not over abundant and the coronary vessels are not prominent. On section of the heart, abundant dark fluid blood escapes from both sides and the heart collapses, diminishing greatly in size. Both right auricle and ventricle are, however, evidently dilated after opening the heart in the usual way, and the columnæ carneæ and papillary muscles are somewhat flattened. The tricuspid ring admits three and one-half fingers, the tricuspid leaflets being large, thin, and pliable with rather long and slender chordæ tendineæ. The entire endocardium of the right heart is smooth and pale except for the presence of small punctate hæmorrhages on the outer wall of the ventricle just beneath the mural flap of the tricuspid valve. The muscle of the right ventricle is thin, pale brown, and rather friable. The pulmonary orifice and valves are normal. The left side of the heart is less dilated, and its endocardium is intact, the mitral ring admitting 2 fingers with ease. The aortic ring and leaflets are normal. Muscle of the left ventricle measures about 12 millimeters at mitral insertion and is firmer than that of the right ventricle; its cut surface is smooth, rather more of a yellowish tinge than normal, although not flecked, and has a glassy appearance. No hæmorrhages are found in the left heart.

Lungs.—Both lungs are diminished in volume and are free from pleural adhesions. The pleura is smooth and moist, and the pigmented lines of the interlobular septa are readily visible. Elasticity of the lungs is diminished,

and the lungs are less crepitant than normal. A few ecchymoses are present on the pleura covering the outer margin of the right lower lobe. On section of the lungs the cut surfaces are smooth, dark red throughout, exuding abundant blood and a moderate amount of frothy fluid. No consolidated areas are found, but the general consistence is increased by the diminished air content, this being especially true of the left lower lobe. The mucosa of the larger bronchi is reddened, its longitudinal striations prominent, and there is present considerable frothy pale fluid.

Organs of neck.—Tongue broad and flat, the papillæ at its base being not prominent. Faucial tonsils not enlarged. Walls of the pharynx are congested. Mucosa of œsophagus is smooth and pale. Mucosa of larynx and trachea is somewhat reddened and a small amount of frothy fluid is found in the trachea. Thyroid gland is not enlarged, and is dark and moist showing the presence of moderate colloid. Cervical lymphatic glands not enlarged.

Spleen lies well posteriorly and is nonadherent. It is somewhat increased in size, and its capsule tense and steel-blue in color. On section, the consistence is somewhat increased, the pulp prominent but firm, being of a dark red color. Lymphoid tissue is scarcely visible, and there is no apparent interstitial increase. No hæmorrhages are seen in the capsule or substance of the gland.

Adrenals are of normal size, the cortex being yellowish with a rather broad pigmented zone. The medulla is relatively prominent.

Kidneys are embedded in a moderate amount of perinephric fat, there being a small hæmorrhage into the peritoneum at the lower pole of the right kidney. The kidneys are of about normal size, and the capsules strip readily from the surfaces, which are smooth and of a dark red color with a few punctate hæmorrhages. On section the cortex is a little broadened and bulges considerably. The cut surface of the cortex is pale reddish brown with a moist glassy appearance. The vascular striæ are not prominent, and the glomeruli are easily visible, enlarged, and for the most part of a red color. The pyramids are very pale and firm. The mucosa of the calyces, pelves, and ureters is pale with the exception of a few small ecchymoses in the pelvis of the left kidney. Renal vessels are in good condition. Urinary bladder, prostate gland, urethra, testes, and seminal vesicles are normal in appearance. A few ecchymoses are present over the dome of the bladder.

Intestines.—The mesentery is fatty and œdematous, its lymphatic glands being small and pink. The large intestine shows no appreciable lesions; it contains a small amount of formed dark fæces. There is possibly a slight excess of mucus in the small intestine. The lymphoid structures of the lower part of the ileum are not unduly prominent. The duodenum shows marked changes in its mucosa. The mucosa is thickened, œdematous, boggy, and as a whole is very red. In addition to its general red color, very numerous small hæmorrhages are readily visible after removing the excessive mucus. The papilla of Vater is unchanged and delivers a golden yellow bile on pressure on the gall bladder.

Stomach is somewhat dilated and contains a small amount of watery fluid. On its posterior surface in the region of the pylorus are very numerous ecchymoses scattered over a rather large area, and the mucosa as a whole is reddened and swollen.

Pancreas is of normal size, firm, pale with distinct lobular markings and patent duct.

Liver and gall bladder.—The gall bladder is small and contains a small amount of golden yellow bile which is readily expressed through the ducts. Common, cystic, and hepatic ducts normal. Liver is of about normal size, its capsule thin, smooth, and transparent. The edges are slightly rounded and the surface smooth and a deep red color with small areas of yellowish mottling. On section the organ is soft and the cut surface smooth. In color it is very deep red, the red masses and strands being rather prominent above the surface, surrounding and including small pin-head-sized areas of a much paler parenchyma. Some few small yellowish foci are seen in the parenchyma. The general architecture of the cut surface is destroyed by the prominence and distribution of the elevated red areas which obliterate the normal markings.

Lymphatic glands of mesentery, retroperitoneal space, and lesser sac are small and pink on section.

Brain.—Structures of scalp are œdematous. Calvarium normal. Dura mater is nonadherent. Longitudinal sinus free. Inner surface of dura mater smooth. There is a slight excess of clear fluid in the meshes of the pia arachnoid over the hemispheres. The meningeal vessels are prominent. Vessels at the base in good condition. Ventricles are not dilated and ependyma is smooth. Section of brain substances shows no gross lesions.

Sections of the viscera were preserved in Zenker's fluid and in 10-per-cent formalin. Sections of the two vagi, anterior tibial, and popliteal nerves were preserved in Müller's fluid.

HISTOLOGICAL EXAMINATION.

Heart.—There is considerable œdema and some increase of the adipose tissue beneath the epicardium and of that between the muscle bundles. The muscle fibers themselves are swollen and granular. When seen in longitudinal section the muscle fibrils are very distinct and in many the nuclei are poor in chromatin. Occasionally vacuoles are seen in the protoplasm of the fibers. Each of these features is much exaggerated when the bundles are seen in transverse section. The fibrils of the muscles are comparatively widely separated and much more readily visible than normal. Irregular vacuolated areas are very frequent, and the nuclei are frequently entirely gone, being replaced by a vacuole or a homogeneous mass which does not take the hæmatoxylin stain. Staining with Sudan III shows very little fat in the muscle fibers. No round-celled foci and no marked multiplication of the nuclei are seen.

Liver.—In the liver the cells in the immediate neighborhood of the central veins are much swollen and granular with indistinct outlines and the portal spaces have a more or less normal appearance. The architecture of the entire remaining portions of the liver is destroyed. In the mid-zone and periphery of the

lobules and sometimes in the central portions the capillaries are widely distended with blood and the arrangement of the cells is distorted. The individual cells show various grades of changes. In some the protoplasm is the seat of small vacuoles while in others the protoplasm has entirely disappeared, leaving a more or less intact nucleus enclosed by the cell membrane—all grades of this change from slight vacuolation up to complete disappearance of the protoplasm may be traced. The nucleus sometimes remains intact, while in others can be seen various stages of disappearance of the chromatin, until simply the shadows of some cells are left. In other areas another type of cell change takes place in which the cell outline is clear but distorted and the cell protoplasm is much more opaque, more homogeneous, and more highly acidophilic than normal. Some of this latter type of cell contain apparently intact nuclei and some even double nuclei, while in others various grades of disappearance of the chromatin are seen down to those in which the nucleus is no longer visible.

While the congestion in these areas is intense, in no place has actual hæmorrhage taken place. No marked bile stasis is recognizable; sections stained with Sudan III show only a very small amount of fatty degeneration.

A few leucocytes surround some of the central veins, and, if regeneration be present, it is certainly not a prominent feature.

Spleen.—The spleen shows some congestion and a rather loose arrangement of the reticulum of the pulp. The congestion is especially marked in the region of the lymphoid follicles. The follicles are relatively small. No other notable changes are seen.

Pancreas.—The pancreas is well formed and shows no changes outside of the islands of Langerhans. Here the cells are very pale and very poorly differentiated from one another, while the nuclei are relatively prominent. Occasionally double nuclei are seen. No changes are seen in the periacinar tissue. The average size of the islands is large, but not larger than within normal limits.

Kidneys.—These show a very severe acute parenchymatous degeneration and some congestion. Little, if any, exudation of cells has taken place. Dilated veins are seen on the surface and a few very small areas of superficial fibrosis.

The convoluted tubules show a marked degeneration of the epithelial cells, and practically all are filled up with a substance which is acidophilic and arranged in the form of a granular reticulum—this is evidently a coagulated, albuminous fluid. The

vessels of the glomeruli are much congested and the cytoplasm of the epithelial cells of the tufts is frequently granular and sometimes vacuolated. Some of the glomerular spaces contain a material similar to that described in the convoluted tubules, but no cellular exudate. The cells lining Bowman's capsule are sometimes high and swollen. In the pyramids the cells of the excretory tubules are intact and no casts are seen, but the tissue between the tubules is very oedematous. Sections stained with Sudan III show no fat.

Stomach and duodenum.—The sections show hæmorrhages in the mucosa without inflammatory condition other than slight catarrh. Marked prominence of acidophilic parietal cells is observed in the pyloric glands.

Nerves.—These were fixed in Müller's fluid and prepared by the Marchi method for the study of the degeneration of nerves. The hæmatoxylin and eosin stain was also employed.

All nerves examined (vagi, phrenics, anterior crural, popliteal, and sciatic) show equally marked changes. The degeneration of the myelin sheaths is very advanced and a large majority of the fibers are affected. In longitudinal sections this degeneration is shown after the Marchi treatment to consist of a marked swelling and fragmentation of the myelin sheath and its collection in masses and globules, giving a varicose or honeycombed appearance to the fibers. No leucocytic infiltration or proliferation of the nuclei of the neurilemma is seen in the sections. Cross sections show fibrils, some partly and some completely surrounded by the degenerated sheath. There is apparently some fragmentation of the nerve fibers themselves. (Plates IV, V, VI, and VII.)

TABLE VI.—Record of rations consumed by prisoners of Group IV.

Prisoner number.	Kind of rice.	Duration of experiment.
26	White rice 81 days; red rice 20 days -----	101 days, February 2 to May 12.
25		
22		
24		
19	White rice -----	92 days, February 2 to May 3.
20		
21		
23		
27	White rice -----	81 days, February 2 to April 23.
28		
29	White rice -----	76 days, February 2 to April 17.

TABLE VI.—*Record of rations consumed by prisoners of Group IV—Contd.*

[illegible]

TABLE VI.—Record of rations consumed by prisoners of Group IV—Contd.

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
Day 8.											
Bread	150	150	150	150	100	150	150	150	150	150	150
Rice	10	50	50	65	35	65	50	50	90	50	50
Starch	5	25	25	35	15	35	25	25	45	25	25
Sugar	5	15	15	15	5	15	15	15	20	15	15
Lard	5	10	10	10	5	10	10	10	15	10	10
Rice	300	300	300	300	300	300	300	300	300	300	300
Bacon	50	50	50	50	50	50	50	50	50	50	50
Day 9.											
Bread	150	150	150	150	150	150	150	150	150	150	150
Rice	200	200	25	200	200	65	200	200	200	200	200
Bacon	30	30	0	30	30	30	30	30	30	30	30
Dinner	No record kept.										
Day 10.											
Rice	300	300	300	300	300	300	300	300	300	250	300
Bananas	100	100	100	100	100	100	100	100	100	100	100
Sugar	0	25	0	25	10	0	25	25	10	25	25
Rice	300	300	300	300	300	300	300	300	300	300	300
Bacon	50	50	50	50	50	50	50	50	50	50	50
Day 11.											
Rice	270	300	300	270	265	265	300	300	265	300	300
Onions	100	100	100	100	100	100	100	100	100	100	100
Lard	15	15	15	15	15	15	15	15	15	15	15
Bread	200	65	200	200	100	200	200	200	175	200	200
Rice	30	60	60	50	50	30	100	100	100	100	60
Starch	15	30	30	25	25	15	50	50	50	50	30
Sugar	10	20	20	10	10	10	25	25	25	25	20
Lard	5	10	10	10	10	5	20	20	20	20	10
Day 12.											
Rice	300	300	300	300	150	300	300	300	300	300	300
Bacon	50	50	0	50	0	50	50	50	50	50	50
Rice	300	150	100	300	150	200	300	150	200	150	300
Bananas	150	150	150	150	150	150	150	150	150	150	150
Sugar	75	75	75	75	35	75	75	75	75	75	75
Day 13.											
Bread	150	150	150	150	20	150	150	150	150	150	150
Rice	60	85	50	60	50	50	100	100	60	100	100
Starch	30	40	25	30	25	25	50	50	30	50	50
Sugar	20	20	10	20	10	10	25	25	20	25	25
Lard	10	15	10	10	10	10	20	20	10	20	20
Rice	350	230	350	350	230	230	350	305	230	305	350
Onions	150	150	150	150	150	150	150	150	150	150	150
Lard	20	20	20	20	20	20	20	20	20	20	20
Day 14.											
Rice	200	200	200	200	200	200	200	200	200	200	200
Bacon	30	30	30	0	30	30	30	30	30	30	30
Rice	300	225	300	300	265	200	300	300	200	300	265
Bacon	50	50	50	50	50	50	50	50	50	50	50
Bread	150	150	150	150	100	150	150	150	150	150	150

TABLE VI.—*Record of rations consumed by prisoners of Group IV—Contd.*

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
Day 15.											
Rice.....	300	300	300	300	265	200	300	300	265	150	300
Bananas.....	150	150	100	150	150	150	150	150	150	150	150
Rice.....	305	350	350	350	350	350	305	305	230	230	305
Onions.....	150	150	150	150	150	150	150	150	150	150	150
Lard.....	20	20	20	20	20	20	20	20	20	20	20
Day 16.											
Rice.....	175	200	200	175	200	175	200	200	150	200	200
Bread.....	150	150	125	150	150	150	150	150	150	150	150
Bacon.....	30	30	30	30	30	30	30	30	30	30	30
Rice.....	300	225	265	265	265	265	225	225	265	265	265
Bacon.....	50	50	50	50	50	50	50	50	50	50	50
Day 17.											
Rice.....	265	300	300	265	265	265	300	300	270	300	300
Bacon.....	50	50	50	50	50	50	50	50	50	50	50
Rice.....	}	No record kept.									
Onions.....											
Lard.....											
Day 18.											
Rice.....	200	200	200	135	200	200	200	200	175	200	200
Bread.....	150	150	135	150	100	100	150	75	150	150	150
Bacon.....	30	30	30	30	30	30	30	30	30	30	30
Rice.....	265	150	40	265	225	200	265	75	150	150	300
Bananas.....	150	150	150	150	150	150	150	150	150	150	150
Sugar.....	75	0	0	0	0	0	0	75	75	75	0
Day 19.											
Rice.....	300	300	300	265	300	270	300	225	265	300	265
Bananas.....	100	100	100	100	100	100	100	100	100	100	100
Sugar.....	0	0	10	0	10	25	0	0	0	0	0
Rice.....	350	350	350	350	350	350	350	350	350	350	350
Onions.....	150	150	150	150	150	150	150	150	150	150	150
Lard.....	20	20	20	20	20	20	20	20	20	20	20
Day 20.											
Rice.....	270	300	300	270	300	300	300	300	270	300	300
Bacon.....	0	50	50	50	50	50	50	50	50	50	50
Rice.....	}	No record kept.									
Bananas.....											
Sugar.....											
Day 21.											
Rice.....	175	175	200	150	180	175	180	200	180	200	175
Bacon.....	30	30	30	30	30	30	30	30	30	30	30
Bread.....	150	150	150	150	135	150	150	20	150	150	150
Rice.....	265	175	0	175	175	230	265	265	280	230	230
Onions.....	150	150	0	150	0	150	150	150	150	0	150
Lard.....	20	20	0	20	0	20	20	20	20	0	20
Day 22.											
Rice.....	300	150	0	300	150	200	300	270	150	300	300
Bananas.....	100	100	50	100	100	100	100	100	100	100	100
Sugar.....	0	0	0	0	0	0	0	0	0	0	0

TABLE VI.—Record of rations consumed by prisoners of Group IV—Contd.

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
<i>Day 22—Continued.</i>											
Rice.....	265	265	300	265	150	265	100	300	270	150	225
Bacon.....	50	50	50	50	50	50	50	25	50	50	50
<i>Day 23.</i>											
Rice.....	225	225	300	300	275	300	225	300	270	300	300
Bacon.....	50	50	50	50	50	50	50	50	50	50	50
Rice.....	150	150	200	40	100	100	200	100	0	300	300
Bread.....	150	150	150	150	100	150	150	150	150	150	150
Onions.....	0	75	50	75	50	150	150	150	150	150	150
<i>Day 24.</i>											
Rice.....	180	100	100	200	180	180	180	200	150	100	200
Bread.....	150	150	75	150	100	150	150	150	150	150	150
Bacon.....	30	30	30	30	30	30	30	30	30	30	30
Rice.....	225	200	225	240	150	240	150	100	200	225	200
Bananas.....	150	150	150	150	150	150	150	150	150	150	150
Sugar.....	75	75	75	75	75	75	75	75	75	75	75
<i>Day 25.</i>											
Rice.....	0	150	75	300	0	225	150	150	225	0	150
Bananas.....	100	100	50	100	50	100	100	100	100	100	100
Sugar.....	25	25	25	25	10	25	25	0	25	0	0
Rice.....	150	240	225	40	100	265	100	240	200	100	300
Onions.....	0	150	75	0	0	150	75	0	150	150	0
Lard.....	0	20	10	0	0	20	10	0	20	20	0
<i>Day 26.</i>											
Rice.....	300	300	300	200	300	300	240	300	300	270	275
Bacon.....	50	50	50	50	50	50	50	50	50	50	50
Rice.....	240	150	75	180	200	225	60	100	150	225	200
Bananas.....	150	150	100	150	150	150	150	150	150	150	150
Sugar.....	75	75	0	75	75	75	75	75	75	75	75
<i>Day 27.</i>											
Rice.....	200	200	200	200	200	200	130	180	180	180	200
Bread.....	150	150	75	150	150	150	150	150	150	150	150
Bacon.....	30	30	30	30	30	30	30	30	30	30	30
Rice.....	310	230	265	350	45	280	350	45	280	45	350
Onions.....	0	75	75	150	0	150	150	50	150	50	150
<i>Day 28.</i>											
Rice.....	300	150	300	300	300	300	300	200	200	200	200
Onions.....	15	50	100	30	30	75	0	75	taste	50	0
Lard.....	5	10	15	5	5	10	0	10	taste	10	0
Rice.....	200	300	200	240	200	240	300	100	200	240	300
Bananas.....	150	150	100	150	150	150	150	150	150	150	150
Sugar.....	75	75	75	75	75	75	75	75	75	75	75
<i>Day 29.</i>											
Rice.....	0	200	300	300	300	300	300	300	250	300	300
Bacon.....	0	50	50	50	50	50	50	50	50	50	50
Rice.....	0	315	305	175	280	280	350	315	305	350	350
Onions.....	0	150	0	0	150	150	150	150	150	150	150
Lard.....	0	20	0	0	20	20	20	20	20	20	20

TABLE VI.—Record of rations consumed by prisoners of Group IV—Contd.

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
<i>Day 30.</i>											
Rice.....	130	175	180	150	175	175	150	200	150	175	200
Bread.....	100	135	150	150	150	150	140	150	150	150	150
Bacon.....	30	30	30	30	30	30	30	30	30	30	30
Rice.....	200	200	100	300	200	200	150	100	225	225	200
Bananas.....	100	150	100	100	100	100	100	100	100	100	100
Sugar.....	0	0	0	25	25	0	25	25	0	0	25
<i>Day 31.</i>											
Rice.....	100	100	200	300	250	200	150	300	225	250	300
Bananas.....	100	100	100	100	100	100	100	100	100	100	100
Sugar.....	0	0	0	0	0	0	0	0	0	0	0
Rice.....	115	230	175	350	230	230	115	305	115	265	175
Onions.....	0	50	50	150	50	100	50	150	75	0	150
Lard.....	0	5	5	20	5	10	10	20	10	0	20
<i>Day 32.</i>											
Rice.....	300	300	300	300	300	0	150	300	150	300	300
Bacon.....	50	50	50	50	50	0	50	50	50	50	50
Rice.....	200	100	100	200	135	(?)	135	180	160	160	150
Bananas.....	150	150	100	150	150	(?)	150	150	150	150	150
Sugar.....	75	75	0	35	25	(?)	75	75	75	0	0
<i>Day 33.</i>											
Rice.....	265	265	100	75	225	(?)	200	265	35	265	200
Bread.....	20	40	120	150	20	-----	20	0	150	25	75
Bacon.....	30	30	30	0	30	-----	30	30	30	30	30
Rice.....	0	115	0	115	0	(?)	175	230	115	230	175
Onions.....	75	75	0	75	0	(?)	100	100	0	0	150
Lard.....	10	10	0	10	0	(?)	15	15	0	0	20
<i>Day 34.</i>											
Rice.....	275	250	270	300	150	-----	300	300	300	240	300
Onions.....	50	50	0	50	0	-----	100	0	100	0	100
Lard.....	10	10	0	10	0	-----	15	0	15	0	15
Rice.....	270	240	240	300	240	-----	225	225	150	240	270
Bananas.....	150	150	150	150	150	-----	150	150	150	150	150
Sugar.....	75	25	75	75	75	-----	75	0	75	75	0
<i>Day 35.</i>											
Rice.....	270	270	240	300	270	-----	200	300	225	225	200
Bananas.....	100	100	100	100	100	-----	100	100	100	100	100
Sugar.....	10	25	25	25	25	-----	0	25	25	25	10
Rice.....	200	300	300	300	225	-----	270	300	240	200	300
Bacon.....	50	50	50	50	50	-----	50	50	50	50	50
<i>Day 36.</i>											
Rice.....	270	265	225	265	200	-----	200	270	270	265	300
Bacon.....	50	50	50	50	50	-----	50	50	50	50	50
Rice.....	265	265	280	350	115	-----	350	350	350	350	350
Onions.....	75	75	0	75	0	-----	150	150	150	150	150
Lard.....	10	10	0	10	0	-----	20	20	20	20	20

TABLE VI.—Record of rations consumed by prisoners of Group IV—Contd.

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
<i>Day 37.</i>											
Rice.....	200	100	180	180	150	-----	100	200	200	200	200
Bread.....	120	150	150	150	50	-----	75	150	150	150	140
Bacon.....	30	30	30	30	30	-----	30	30	30	30	30
Rice.....	265	200	150	300	275	-----	225	250	200	250	300
Bananas.....	150	150	150	150	150	-----	150	100	150	150	150
Sugar.....	0	0	0	40	0	-----	75	75	75	75	0
<i>Day 38.</i>											
Rice.....	240	225	0	200	250	-----	240	250	100	300	275
Bananas.....	100	100	100	100	100	-----	100	100	100	100	100
Sugar.....	0	0	0	0	25	-----	0	0	0	0	0
Rice.....	210	305	45	280	175	-----	230	230	280	280	230
Onions.....	0	75	0	0	0	-----	0	150	0	150	0
Lard.....	0	10	0	0	0	-----	0	20	0	20	0
<i>Day 39.</i>											
Rice.....	270	300	275	300	200	-----	240	300	225	300	300
Bacon.....	50	50	50	50	50	-----	50	50	50	50	50
Rice.....	240	225	150	300	240	-----	300	75	0	300	240
Bananas.....	150	150	150	150	150	-----	150	150	150	150	150
Sugar.....	75	75	75	75	75	-----	75	75	75	75	75
<i>Day 40.</i>											
Rice.....	175	175	130	175	200	-----	130	165	180	170	150
Bread.....	150	150	75	75	75	-----	75	75	150	75	75
Bacon.....	30	30	15	30	30	-----	30	30	30	30	30
Rice.....	240	200	150	240	150	-----	300	300	200	300	300
Onions.....	50	0	50	100	0	-----	150	0	50	0	150
Lard.....	5	0	5	10	0	-----	20	0	5	0	20
<i>Day 41.</i>											
Rice.....	250	225	150	300	240	-----	265	300	300	300	300
Onions.....	100	100	0	100	0	-----	100	100	50	35	100
Lard.....	15	15	0	15	0	-----	15	15	10	5	15
Rice.....	225	265	150	265	200	-----	200	250	200	275	300
Bananas.....	150	150	150	150	150	-----	150	150	150	150	150
Sugar.....	0	0	0	75	50	-----	0	75	0	75	0
<i>Day 42.</i>											
Rice.....	300	240	60	300	200	-----	200	300	150	300	300
Bananas.....	100	100	100	100	100	-----	100	50	100	100	100
Sugar.....	10	0	0	0	20	-----	25	0	10	25	0
Rice.....	240	265	265	240	275	-----	265	200	200	300	300
Bacon.....	50	50	50	50	50	-----	50	50	50	50	50
<i>Day 43.</i>											
Rice.....	265	240	240	300	275	-----	150	300	225	265	300
Bacon.....	50	50	35	50	50	-----	0	25	50	50	50
Rice.....	175	0	85	280	280	-----	230	350	310	350	350
Onions.....	75	0	0	0	0	-----	75	150	150	150	150
Lard.....	10	0	0	0	0	-----	10	20	20	20	20

TABLE VI.—Record of rations consumed by prisoners of Group IV—Contd.

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
<i>Day 44.</i>											
Rice.....	100	100	150	-----	65	-----	200	135	200	200	135
Bread.....	150	150	150	-----	75	-----	0	150	150	150	75
Bacon.....	30	30	15	-----	15	-----	30	30	30	30	30
Rice.....	240	250	75	250	150	250	200	240	265	300	265
Bananas.....	150	150	150	150	150	150	150	150	150	150	150
Sugar.....	0	75	0	75	75	75	75	0	75	75	0
<i>Day 45.</i>											
Rice.....	200	150	0	200	150	100	200	265	225	300	265
Bananas.....	100	100	50	100	100	100	100	100	100	100	100
Sugar.....	0	25	0	25	25	0	25	0	0	0	0
Rice.....	115	265	175	115	60	230	175	175	0	175	230
Onions.....	75	150	0	100	0	0	150	150	0	75	75
Lard.....	10	20	0	15	0	0	20	20	0	10	10
<i>Day 46.</i>											
Rice.....	225	240	225	240	240	225	100	75	150	300	240
Bacon.....	50	50	50	50	50	50	50	50	50	50	50
Rice.....	150	265	75	200	100	250	225	150	150	300	200
Bananas.....	150	150	50	150	150	150	150	150	150	150	150
Sugar.....	75	75	75	75	35	75	75	0	0	75	0
<i>Day 47.</i>											
Rice.....	100	135	135	100	80	135	100	200	160	160	100
Bread.....	150	100	75	150	150	100	50	150	120	75	75
Bacon.....	30	30	30	30	30	0	15	30	30	30	30
Rice.....	115	230	115	230	175	230	80	280	350	350	350
Onions.....	75	50	0	35	75	75	150	80	75	150	0
Lard.....	10	5	0	5	10	10	20	15	10	20	0
<i>Day 48.</i>											
Rice.....	75	60	60	150	75	200	240	300	225	300	300
Onions.....	25	100	20	100	25	35	100	100	100	0	0
Lard.....	5	15	3	15	5	5	15	15	15	0	0
Rice.....	250	265	40	300	265	265	300	0	300	300	300
Bananas.....	150	150	150	150	150	150	150	150	150	150	150
Sugar.....	75	75	75	35	0	75	75	0	35	75	35
<i>Day 49.</i>											
Rice.....	240	200	0	200	200	150	275	240	265	300	225
Bananas.....	100	100	100	100	100	100	100	100	100	100	100
Sugar.....	0	25	5	5	25	0	25	25	25	25	10
Rice.....	150	300	300	225	265	200	100	275	100	300	300
Bacon.....	50	50	50	50	50	50	50	50	50	50	50
<i>Day 50.</i>											
Rice.....	150	150	300	100	75	150	200	300	200	300	300
Onions.....	100	100	100	100	100	50	50	100	100	100	100
Lard.....	15	15	15	15	15	10	15	15	15	15	15
Rice.....	150	150	taste	225	150	225	275	100	240	300	275
Bananas.....	150	150	150	150	150	150	150	150	150	150	150
Sugar.....	35	35	35	75	20	0	0	75	75	35	35

TABLE VI.—*Record of rations consumed by prisoners of Group IV—Contd.*

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
<i>Day 51.</i>											
Rice	135	170	165	200	175	165	175	200	170	200	150
Bread	100	150	150	150	150	150	150	150	150	150	150
Bacon	30	30	30	30	30	30	30	30	30	30	30
Rice	0	230	85	265	175	175	230	350	175	350	350
Onions	150	75	0	75	0	75	150	150	150	150	150
Lard	20	10	0	10	0	10	20	20	20	20	20
<i>Day 52.</i>											
Rice	150	200	240	300	225	225	240	265	0	300	225
Bananas	150	150	150	150	150	150	150	150	150	150	150
Sugar	25	25	0	25	25	25	25	25	0	0	10
Rice	70	230	40	175	40	265	230	290	265	350	305
Onions	150	150	0	150	150	40	150	150	40	150	40
Lard	20	20	0	20	20	5	20	20	5	0	5
<i>Day 53.</i>											
Rice	35	225	300	300	75	300	300	300	300	300	300
Bacon	50	50	50	50	50	50	50	50	50	50	50
Rice	150	225	30	300	35	250	150	225	0	300	225
Bananas	150	150	150	150	100	150	150	150	150	150	150
Sugar	40	75	0	75	40	75	75	40	0	40	40
<i>Day 54.</i>											
Rice	100	300	300	300	75	300	300	300	200	300	300
Onions	50	100	100	100	100	50	100	100	50	100	100
Lard	10	15	15	15	15	10	15	15	10	15	15
Rice	240	300	300	300	30	250	300	300	275	300	300
Bacon	50	50	50	50	50	50	50	50	50	50	50
<i>Day 55.</i>											
Rice	100	80	160	200	65	175	50	35	0	180	160
Bread	150	150	150	150	0	110	150	125	75	150	75
Bacon	30	30	30	30	15	30	30	30	30	30	30
Rice	275	180	50	265	100	200	265	280	35	275	200
Bananas	150	150	100	150	100	150	150	150	100	150	150
Sugar	15	75	20	0	0	0	0	0	0	75	0
<i>Day 56.</i>											
Rice	300	150	300	300	100	265	200	150	225	300	300
Bacon	50	50	50	50	50	50	50	50	50	50	50
Rice	230	265	230	230	90	265	280	280	175	305	280
Onions	0	0	150	150	0	150	150	150	75	75	150
Lard	0	0	20	20	0	20	20	20	10	10	20
<i>Day 57.</i>											
Rice	265	225	75	300	100	240	150	300	240	265	240
Bananas	100	100	100	100	100	100	100	0	100	100	100
Sugar	0	0	0	25	5	0	0	0	25	10	0
Rice	305	305	315	350	230	230	305	350	305	305	350
Onions	0	150	150	150	0	0	150	150	50	150	150
Lard	0	20	20	20	0	0	20	20	10	20	20
<i>Day 58.</i>											
Rice	150	160	150	175	135	150	175	200	175	175	175
Bread	50	150	50	150	50	150	150	150	150	50	110

TABLE VI.—Record of rations consumed by prisoners of Group IV—Contd.

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
<i>Day 58—Continued.</i>											
Bacon.....	30	30	30	30	30	30	30	30	30	30	30
Rice.....	100	265	150	150	150	240	300	225	100	300	300
Bananas.....	150	150	150	150	150	150	150	150	150	150	150
Sugar.....	0	0	5	10	0	25	0	0	0	25	10
<i>Day 59.</i>											
Rice.....	150	265	100	225	150	265	200	35	0	225	200
Bananas.....	100	100	100	100	50	100	100	0	0	100	100
Sugar.....	0	0	10	10	0	0	0	0	0	25	0
Rice.....	100	300	200	300	100	225	150	75	150	300	300
Bacon.....	50	50	50	50	50	50	50	50	50	50	50
<i>Day 60.</i>											
Rice.....	200	35	100	100	35	200	0	0	0	150	30
Onions.....	100	100	30	50	100	50	100	0	0	50	50
Lard.....	15	15	5	10	15	10	15	0	0	10	10
Rice.....	300	200	250	225	150	265	150	300	0	300	300
Bacon.....	50	50	50	50	50	50	50	50	0	50	50
<i>Day 61.</i>											
Rice.....	35	150	100	225	35	150	225	300	0	300	250
Bananas.....	100	0	100	100	0	100	100	100	100	100	100
Sugar.....	25	0	0	0	0	0	0	0	0	0	25
Rice.....	225	225	250	300	225	250	225	100	250	225	300
Bacon.....	50	50	50	50	50	50	50	50	50	50	50
<i>Day 62.</i>											
Rice.....	135	150	150	150	135	175	175	200	175	175	200
Bread.....	50	150	150	150	50	150	100	150	135	150	135
Bacon.....	30	30	30	30	30	30	30	30	30	30	30
Rice.....	175	175	45	60	35	265	230	350	300	150	350
Onions.....	150	taste	0	taste	150	taste	150	150	75	100	150
Lard.....	20	taste	0	taste	20	taste	20	20	10	15	20
<i>Day 63.</i>											
Rice.....	(?)	75	250	150	30	200	150	275	150	300	250
Bacon.....	(?)	50	50	50	50	50	50	50	50	50	50
Rice.....	(?)	100	0	250	225	250	225	250	225	300	250
Bananas.....	(?)	50	100	150	100	150	150	150	150	150	150
Sugar.....	(?)	0	20	0	15	0	0	0	20	25	20
<i>Day 64.</i>											
Rice.....	150	taste	taste	300	150	200	240	300	40	275	200
Onions.....	0	0	0	0	0	0	0	0	0	0	0
Rice.....	150	150	150	300	150	200	300	300	265	265	240
Bacon.....	0	0	0	0	0	0	0	0	0	0	0
<i>Day 65.</i>											
Rice.....	265	200	40	225	265	265	200	200	225	40	225
Bananas.....	100	100	50	100	50	100	100	100	100	100	100
Sugar.....	0	25	5	25	0	25	25	25	25	0	0
Rice.....	175	265	265	265	265	265	175	265	115	175	175
Onions.....	0	110	75	110	0	110	150	0	75	110	75
Lard.....	0	15	10	15	0	15	20	0	10	15	10

TABLE VI.—Record of rations consumed by prisoners of Group IV—Contd.

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
<i>Day 66.</i>											
Rice.....	175	165	150	200	160	200	200	200	0	65	200
Bread.....	150	150	150	150	75	150	150	150	150	150	150
Bacon.....	30	30	30	30	30	30	30	30	30	30	30
Rice.....	185	200	150	185	150	150	185	300	150	75	300
Bacon.....	50	50	50	50	50	50	50	50	50	50	50
<i>Day 67.</i>											
Rice.....	250	250	200	300	150	270	75	300	200	0	300
Onions.....	100	100	50	100	100	50	100	100	50	0	50
Lard.....	15	15	10	15	15	10	15	15	10	0	10
Rice.....	200 ^a	100	100	225	150	265	200	265	265	300	300
Bananas.....	150	150	100	150	150	150	150	150	150	0	150
Sugar.....	75	75	0	75	35	0	0	75	taste	0	taste
<i>Day 68.</i>											
Rice.....	300	300	300	300	300	300	300	300	300	(a)	300
Bacon.....	50	50	50	50	50	50	50	50	50	(a)	50
Rice.....	230	175	175	350	0	230	350	350	305	(a)	305
Onions.....	150	taste	0	taste	150	75	150	0	100	(a)	0
Lard.....	20	taste	0	taste	20	10	20	0	15	(a)	0
<i>Day 69.</i>											
Rice.....	265	225	225	265	265	225	275	300	300	(a)	300
Bananas.....	100	100	50	100	100	100	0	100	100	(a)	100
Sugar.....	25	25	10	25	10	10	taste	25	25	(a)	10
Rice.....	100	250	265	225	200	265	300	300	265	(a)	300
Bacon.....	50	50	50	50	50	50	50	50	50	(a)	50
<i>Day 70.</i>											
Rice.....	150	150	125	175	150	175	100	175	150	(a)	175
Bread.....	150	110	135	150	110	135	150	150	150	(a)	135
Bacon.....	30	30	30	30	30	30	30	30	30	(a)	30
Rice.....	40	115	175	60	115	230	175	175	45	(a)	175
Onions.....	150	75	0	150	150	150	150	150	150	(a)	50
Lard.....	20	10	0	20	20	20	20	20	20	(a)	5
<i>Day 71.</i>											
Rice.....	240	225	200	240	225	275	240	300	240	(a)	300
Bacon.....	50	50	50	50	50	50	50	50	50	(a)	50
Rice.....	75	0	60	0	100	100	200	150	150	(a)	270
Bananas.....	100	150	50	150	100	50	100	0	150	(a)	150
Sugar.....	0	75	taste	0	0	0	0	0	0	(a)	0
<i>Day 72.</i>											
Rice.....	225	300	300	240	200	275	300	300	300	(b)	300
Onions.....	0	100	30	50	30	50	100	0	65	-----	100
Lard.....	0	15	5	10	5	10	15	0	10	-----	15
Rice.....	240	300	300	300	265	300	250	300	265	-----	265
Bacon.....	50	50	50	50	50	50	50	50	50	-----	50
<i>Day 73.</i>											
Rice.....	150	240	150	225	150	200	0	150	0	-----	300
Bananas.....	100	100	100	100	100	100	0	0	100	-----	50
Sugar.....	10	10	10	0	10	0	0	0	taste	-----	10

^a Left with prisoner.^b Diet discontinued.

TABLE VI.—Record of rations consumed by prisoners of Group IV—Contd.

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
<i>Day 73—Continued.</i>											
Rice.....	230	230	175	175	45	230	175	175	350	-----	290
Onions.....	150	150	0	150	150	0	0	150	150	-----	75
Lard.....	20	20	0	20	20	0	0	20	20	-----	10
<i>Day 74.</i>											
Rice.....	135	150	135	200	135	175	150	200	160	-----	165
Bread.....	150	150	150	150	75	75	75	150	150	-----	120
Bacon.....	30	30	30	30	30	30	30	30	30	-----	30
Rice.....	200	150	150	200	150	265	200	75	300	-----	300
Bacon.....	50	50	50	50	50	50	50	50	50	-----	50
<i>Day 75.</i>											
Rice.....	100	150	225	225	225	240	225	200	300	-----	200
Onions.....	25	30	25	25	30	50	50	0	100	-----	0
Lard.....	5	5	5	5	5	10	10	0	15	-----	0
Rice.....	150	225	240	200	200	265	265	265	240	-----	300
Bananas.....	0	150	150	150	100	150	50	0	0	-----	150
Sugar.....	0	75	15	25	20	25	0	0	20	-----	0
<i>Day 76.</i>											
Rice.....	150	240	250	300	200	240	265	265	300	-----	300
Bacon.....	50	50	50	50	50	50	50	50	50	-----	50
Rice.....	75	200	100	175	115	175	230	230	230	-----	265
Onions.....	0	0	50	0	0	50	0	0	0	-----	0
Lard.....	0	0	10	0	0	10	0	0	0	-----	0
<i>Day 77.</i>											
Rice.....	200	200	150	200	100	150	300	240	265	-----	300
Bananas.....	100	100	100	100	100	100	100	100	100	-----	100
Sugar.....	0	0	10	5	0	10	0	0	0	-----	0
Rice.....	75	200	200	250	150	225	240	0	225	-----	275
Bacon.....	50	50	50	50	50	50	0	0	50	-----	50
<i>Day 78.</i>											
Rice.....	0	0	0	100	taste	100	0	0	0	-----	0
Bread.....	150	20	150	150	150	150	150	150	150	-----	150
Bacon.....	30	30	30	30	30	30	30	30	10	-----	30
Rice.....	0	175	85	175	115	280	85	35	175	-----	350
Onions.....	0	75	20	150	150	20	taste	0	0	-----	150
Lard.....	0	10	5	20	20	5	taste	0	0	-----	20
<i>Day 79.</i>											
Rice.....	0	100	150	150	150	200	240	300	150	-----	300
Bacon.....	50	50	50	50	50	50	50	0	0	-----	50
Rice.....	0	240	200	240	240	225	300	200	265	-----	265
Bananas.....	0	150	150	150	150	150	150	150	150	-----	150
Sugar.....	0	0	35	taste	taste	taste	0	0	0	-----	35
<i>Day 80.</i>											
Rice.....	150	35	150	150	30	200	100	30	240	-----	200
Onions.....	0	0	0	0	0	0	0	0	0	-----	0
Rice.....	^a 150	240	240	100	225	240	75	300	^c 35	-----	300
Bacon.....	50	50	50	50	50	50	50	50	50	-----	50

^a Red rice substituted for white rice for next 20 days.

TABLE VI.—Record of rations consumed by prisoners of Group IV—Contd.

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
<i>Day 81.</i>											
Rice.....	0	200	200	200	150	200	150	225	30	-----	240
Bananas.....	100	100	100	100	100	100	100	100	100	-----	100
Rice.....	200	200	150	150	265	225	240	300	300	-----	240
Fish.....	30	30	30	30	30	30	30	30	30	-----	30
<i>Day 82.</i>											
Rice.....	250	240	240	300	300	265	(a)	(a)	150	-----	300
Fish.....	30	30	30	30	30	30	-----	-----	15	-----	30
Rice.....	150	225	150	225	225	225	-----	-----	300	-----	225
Potatoes.....	150	150	150	150	150	150	-----	-----	150	-----	150
Bacon.....	50	50	0	0	50	50	-----	-----	0	-----	50
<i>Day 83.</i>											
Rice.....	No record kept.										
Potatoes.....											
Bacon.....											
Rice.....	200	225	200	250	300	300	-----	-----	300	-----	250
Fish.....	30	30	30	30	30	30	-----	-----	30	-----	30
<i>Day 84.</i>											
Rice.....	0	225	40	200	225	150	-----	-----	300	-----	150
Bananas.....	0	100	50	100	100	100	-----	-----	100	-----	100
Rice.....	50	200	180	135	180	180	-----	-----	200	-----	50
Bread.....	150	150	150	150	150	150	-----	-----	150	-----	150
Bacon.....	30	30	30	30	30	30	-----	-----	30	-----	30
<i>Day 85.</i>											
Rice.....	265	265	200	265	300	265	-----	-----	300	-----	300
Fish.....	25	25	25	25	25	25	-----	-----	25	-----	25
Potatoes.....	100	100	100	100	100	100	-----	-----	100	-----	100
Rice.....	265	265	265	175	265	265	-----	-----	350	-----	175
Onions.....	0	0	0	0	0	0	-----	-----	0	-----	0
<i>Day 86.</i>											
Rice.....	300	300	250	300	300	275	-----	-----	300	-----	300
Fish.....	40	40	40	40	40	40	-----	-----	40	-----	40
Rice.....	225	265	225	150	40	225	-----	-----	300	-----	265
Potatoes.....	100	100	100	100	100	100	-----	-----	100	-----	100
Bacon.....	30	30	30	30	0	30	-----	-----	30	-----	30
<i>Day 87.</i>											
Rice.....	240	265	225	225	240	225	-----	-----	240	-----	150
Potatoes.....	100	100	100	100	100	100	-----	-----	100	-----	100
Fish.....	30	30	30	30	30	30	-----	-----	30	-----	30
Starch.....	10	10	10	10	10	10	-----	-----	10	-----	10
Lard.....	15	15	15	15	15	15	-----	-----	15	-----	15
Rice.....	225	150	75	75	75	225	-----	-----	300	-----	75
Bacon.....	50	50	50	50	0	50	-----	-----	50	-----	0
<i>Day 88.</i>											
Rice.....	300	250	200	300	150	300	-----	-----	300	-----	150
Potatoes.....	100	100	100	100	100	100	-----	-----	100	-----	100
Bacon.....	30	30	30	30	30	30	-----	-----	30	-----	30
Rice.....	265	150	40	150	40	100	-----	-----	300	-----	75
Bananas.....	150	150	50	150	50	50	-----	-----	150	-----	150

^a Diet discontinued.

TABLE VI.—Record of rations consumed by prisoners of Group IV—Contd.

Diet.	Amount, in grams, consumed by prisoner number—										
	26	22	24	19	20	21	27	28	25	29	23
Day 89.											
Rice.....	265	240	225	300	150	240			300		200
Fish.....	30	30	30	30	30	30			30		30
Rice.....	300	225	150	150	75	150			300		225
Potatoes.....	100	100	100	100	100	100			100		100
Bacon.....	30	30	30	30	30	30			30		30
Day 90.											
Rice.....	300	250	150	250	240	200			300		300
Potatoes.....	100	100	100	100	100	100			100		100
Fish.....	30	30	30	30	30	30			30		30
Rice.....	305	230	45	175	115	115			350		45
Bananas.....	150	150	0	150	150	150			150		150
Sugar.....	75	0	0	0	taste	0			0		0
Day 91.											
Rice.....	300	225	35	150	150	150			300		225
Bacon.....	50	50	0	50	5	50			50		0
Rice.....	}	No record kept.									
Potatoes.....											
Fish.....											
Day 92.											
Rice.....	300	0	0	300	300	0			300		300
Bananas.....	100	0	0	100	100	0			100		100
Sugar.....	25	0	0	25	25	0			25		25
Rice.....	300	(a)	(a)	(a)	(a)	(a)			300		(b)
Potatoes.....	100								100		
Bacon.....	30								30		
Day 93.											
Rice.....	300								300		
Fish.....	30								30		
Starch.....	15								15		
Lard.....	10								10		
Dinner.....	No record kept.										
Day 94.											
Rice.....	240								300		
Potatoes.....	100								100		
Bacon.....	30								30		
Rice.....	300								300		
Potatoes.....	100								100		
Day 95.											
Rice.....	300								300		
Bananas.....	150								150		
Sugar.....	25								25		
Rice.....	150								300		
Potatoes.....	100								100		
Bacon.....	30								30		
Day 96.											
Rice.....	300								300		
Fish.....	30								30		
Rice.....	300								300		

^a Diet discontinued.

TABLE VI.—*Record of rations consumed by prisoners of Group IV—Contd*

[illegible]

TABLE VII.—*Regular prison diet for native and Asiatic prisoners.*

(Components and quantities of the ration.)

Components.	Quantities.						
	Sunday.	Monday.	Tues- day.	Wednes- day.	Thurs- day.	Friday.	Satur- day.
	<i>Grams.</i>	<i>Grams.</i>	<i>Grams.</i>	<i>Grams.</i>	<i>Grams.</i>	<i>Grams.</i>	<i>Grams.</i>
Beef, forequarter	130			120			150
Pork, fresh		70			70		
Fish, dry			150			150	
Mongos	100	160		150	150		120
Potatoes		200	150	150	200	100	250
Camotes	500		150	200	200	150	
Onions		100	50	150		100	
Rice	400	400	400	400	400	400	400
Sugar	50	50	50	50	50	50	50
Salt	20	20	20	20	20		20
Tea	40	60				40	
Coffee			60		60		
Tomatoes			50			50	
Ginger-root				60			60
Vinegar					60		
Bread	166	166	166	166	166	166	166

TABLE VIII.—*Showing nature of the rice received by the different groups.*

Case No.	Group and rice received.	Total days.
GROUP I.		
4	White rice + rice polishings for 13 days, followed by white rice + extract of rice polishings for 84 days.	97
2		
1	White rice + rice polishings for 13 days, followed by white rice + extract of rice polishings for 95 days.	108
6		
5		
8		
GROUP II.		
7	White rice for 97 days, followed by red rice for 20 days -----	117
8		
11	White rice-----	97
9		
10	White rice-----	108
12		
GROUP III.		
14	White rice + rice polishings for 17 days, followed by red rice for 80 days -----	97
16		
18	White rice + rice polishings for 17 days, followed by red rice for 100 days -----	117
13		
15		
16		
17		
GROUP IV.		
26	White rice 81 days, followed by red rice for 20 days-----	101
25		
22		
24		
19	White rice-----	92
20		
21		
23		
27	White rice-----	82
28		
29	White rice-----	75

SUMMARY OF THE RESULTS OF THE EXPERIMENTS.

If now we compare the results of the experiments in the different groups, it may be seen that in Group I, where the diet consisted largely of white rice together with extract of rice polishings, 4 of the 6 individuals comprising the group developed no symptoms of beriberi during the time of the experiment. One, No. 1, developed rather marked early symptoms of beriberi and one, No. 3, developed some of the early symptoms of this

disease. The symptoms of these cases did not improve until the monotony of the diet was varied by the addition of dried codfish and potatoes. Nos. 4 and 6 of this group suffered merely from erosions about the corners of the mouths during the experiment. It seems advisable to consider briefly the symptoms in the cases which suggested the diagnosis of beriberi. In case No. 1 the loss of weight was constant throughout the course of the experiment until the diet was changed, the individual losing in all 7.9 kilograms (17.5 pounds) in weight. From the time that fish and potatoes were added to the diet he began to gain slightly in weight and the unfavorable symptoms to improve. The striking symptoms suggestive of beriberi in this case were the slight increase of knee jerks noticed first on the eighty-first day of the experiment, pain in the abdomen, the huskiness and almost complete loss of the voice, the development of tachycardia, epigastric pulsation, slight œdema of the legs, and tenderness of the calves. These symptoms certainly were suggestive of beriberi. While it is an acknowledged fact that all cases of beriberi do not show loss of knee jerks and that usually, if perhaps not always, this symptom is a late one in the course of the disease, nevertheless in an experiment of this nature a definite diagnosis of beriberi was not made unless the loss of knee jerks had occurred in conjunction with the appearance of other symptoms of this disease. Also, it obviously is impossible to state whether, had the diet been continued for a longer period of time in this case, more definite symptoms of beriberi would have developed, but his condition and the progression of the symptoms certainly suggested such a course. In any case, a condition simulating beriberi was produced in this individual. In case No. 3 the patient lost in weight almost continuously up to the eighty-fourth day of the experiment, 4.5 kilograms (10 pounds) in all. The only symptoms of beriberi which were noted were the development of abdominal pain, visible epigastric pulsation, pain and tenderness in the calves of the legs, and huskiness of the voice. These symptoms improved upon the addition of dried codfish and potatoes to the diet, but the patient did not gain in weight until placed upon the regular prison ration. (See Table VII.) The dried codfish, as may be seen from Table II, contained 2.9 per cent phosphorus pentoxide,

but the potatoes only 0.25 per cent, which is less than the amount present in the white polished rice (0.37 per cent) employed in the experiments. The loss of weight in the subjects comprising this group, during the experiment, was as follows:

GROUP I.

Case.	Lost—		Then gained—	
	Kilograms.	Equivalent in pounds.	Kilograms.	Equivalent in pounds.
No. 1 ^a	7.9	17.5		
No. 2.....	2.9	6.5		
No. 3 ^a	4.5	10.0		
No. 4.....	2.04	4.5		
No. 5.....	2.04	4.5	2.9	6.5
No. 6.....	4.3	9.5		

^a Developed symptoms of beriberi.

In none of the other cases of this group was the loss of weight so marked as in case No. 1, though case No. 6, in which no symptoms of beriberi developed, lost practically as much (4.3 kilograms or 9.5 pounds) as did case No. 3.

In Groups II and IV the diet consisted largely of white rice. In Group II, 4 of the 6 individuals comprising the experiment developed beriberi (Nos. 8, 9, 10, 11) and 2 (Nos. 7 and 12) early symptoms of the disease, while in Group IV, 4 of the 11 (Nos. 20, 26, 25, 29) developed beriberi, 2 (Nos. 19 and 22) developed early symptoms of the disease, 1 (No. 21) doubtful symptoms, and 3 (Nos. 24, 27, 28) showed no symptoms of beriberi throughout the experiment.

It is also advisable to examine into the symptoms of beriberi which developed in the individuals comprising these groups. In case No. 8 of Group II the most striking symptoms were the œdema of the legs and tenderness of the calf muscles, loss of knee jerks, and change in the position of the apex beat of the heart. In case No. 9, epigastric pain and pulsation, marked dyspnœa, paræsthesia and hyperæsthesia of areas of the skin, and hyperæsthesia of the muscles of the calves, together with loss of knee jerks. In case No. 10 the prominent symptoms were cardiac disturbances, hyperæsthesia of the calf muscles, and

loss of knee jerks, while in No. 11 paræsthesia, hyperæsthesia of the calf muscles, cardiac disturbances, loss of knee jerks, and development of foot drop occurred. In No. 7 the most striking symptoms suggesting the development of beriberi were anæsthesia and paræsthesia of areas of the skin, hyperæsthesia of the calf muscles, and cardiac disturbances. The knee jerks were absent before the experiment commenced and remained so. In No. 12, cardiac disturbances, pain and tenderness of the calf muscles, and œdema of the legs occurred.

The loss of weight in the subjects comprising this group during the experiment was as follows:

GROUP II.

Case.	Lost—	
	Kilograms.	Equivalent in pounds.
No. 7 -----	6.1	13.5
No. 8 ^a -----	4.5	10.0
No. 9 ^a -----	6.1	13.5
No. 10 ^a -----	2.7	6.0
No. 11 ^a -----	3.6	8.0
No. 12 -----	3.4	7.5

^a Developed beriberi.

In considering the cases of Group IV, we find that in case No. 20 the most striking symptoms of beriberi which developed during the course of the experiment were cardiac disturbances, pain and tenderness in the calf muscles, and loss of knee jerks. In case No. 26 there occurred hyperæsthesia of the skin over the fingers and toes, loss of power of the grip of the hands, loss of knee jerks, and unsteadiness when standing with the eyes closed. In No. 25 the striking symptoms were weakness of the legs and tenderness in the calf muscles, and slight œdema of the legs, while in No. 29 marked œdema of the legs and face, epigastric pain, loss of knee jerks, cardiac disturbances, and collapse were the prominent symptoms. In case No. 19 the suggestive symptoms were pain in the legs and arms, the feebleness of the grip of the hands, paræsthesia and slight tenderness of the calves, and slight œdema over the tibiæ, while in No. 22

there was marked œdema of the legs and moderate tenderness of the calf muscles. In No. 21 slight cardiac disturbances, œdema of the legs, and hyperæsthesia of the muscles of the calves were present. The loss of weight in the subjects of this group during the course of the experiment was as follows:

GROUP IV.

Case.	Lost—		Then gained—	
	Kilograms.	Equivalent in pounds.	Kilograms.	Equivalent in pounds.
No. 19 ^a	1.3	3.0	2.2	5.0
No. 20 ^b	2.7	6.0	.....	.....
No. 21	6.8	15.0	3.6	8.0
No. 26 ^b	7.4	16.5	.....	.....
No. 25 ^b	3.6	8.0	.....	.....
No. 22 ^a	2.0	4.5	.....	.....
No. 23	2.2	5.0	2.4	5.5
No. 24	2.9	6.5	.....	.....
No. 27	4.5	10.0	1.3	3.0
No. 28	2.7	6.0	1.5	3.5
No. 29 ^b	0.0	0.0	.....	.....

^a Developed symptoms of beriberi.

^b Developed beriberi.

In Group III, where the diet consisted largely of red rice, only 1 (No. 13) of the 6 developed rather marked symptoms of beriberi, while 1 (No. 18) developed only slight cardiac symptoms. In Nos. 14, 15, 16, and 17 no symptoms at all of the disease developed. In No. 13 the most striking symptoms suggestive of beriberi were pain and tenderness in the epigastrium, symptoms suggesting paræsthesia, epigastric pulsation, cardiac disturbances and dyspnœa, and marked diminution and almost disappearance of the knee jerks, so that it was very difficult or impossible at times to elicit them. The condition of this individual, at the time that his diet was changed, certainly led one to believe that had the diet been persisted with, a well-marked case of beriberi would have developed. In No. 18, epigastric pulsation and slight cardiac disturbances appeared, but these symptoms did not persist. In No. 15 erosions at the edges of the lips and conjunctivitis developed, and in No. 17 catarrhal conjunctivitis also occurred. The loss of weight in the subjects of this group during the experiment was as follows:

GROUP III.

Case.	Lost—		Then gained—	
	Kilograms.	Equivalent in pounds.	Kilograms.	Equivalent in pounds.
No. 13 ^a	6.8	15.0	.....	.....
No. 14	4.3	9.5	.....	.....
No. 15	5.2	11.5	.....	.....
No. 16	2.4	5.5	2.0	4.5
No. 17	3.6	8.0	2.0	4.5
No. 18 ^a	2.4	5.5	.....	.....

^a Developed symptoms of beriberi.

From an examination of the tables showing the loss of weight in the patients in the four groups, it is seen that in some instances the loss of weight in those individuals who developed beriberi was marked, for example, No. 8, 4.5 kilograms (10 pounds); No. 9, 6.1 kilograms (13.5 pounds); and No. 26, 7.4 kilograms (16.5 pounds). In other cases, Nos. 10, 20, and 25, it was slight, 6, 6, and 8 kilograms, respectively, while in the most acute case, No. 29, there was no loss of weight at the end of sixty-one days when the patient died.

Cases Nos. 1 and 3 of Group I lost more in weight than any other members of the group, namely 7.9 and 4.5 kilograms (17.5 and 10 pounds), respectively, and were the only members of the group that developed symptoms suggestive of beriberi. No. 1 developed much more marked symptoms than No. 3. However, case No. 6 of the same group lost 4.3 kilograms (9.5 pounds) and developed no symptoms of the disease. Case No. 13 of Group III lost 6.8 kilograms (15 pounds) in weight, more than any other member of the group, and was the only one of the group to develop striking symptoms of beriberi. But case No. 7 of Group II developed no symptoms of beriberi and lost 6.1 kilograms (13.5 pounds), and case No. 21 of Group IV lost 6.8 kilograms (15 pounds) in the earlier part of the experiment, and also developed no symptoms of the disease. Apparently, therefore, the development of the symptoms of beriberi did not necessarily occur in at least all of these cases on account of the loss of weight, though it is certainly suggestive in cases No. 1 of Group I and No. 13 of Group III that there might be some connection between the loss of weight and the development of

the symptoms. We find no record in the literature as to whether during the incubation period of beriberi there is frequently or usually a loss in weight. All of our cases which developed beriberi showed a preliminary loss of weight, varying from 2.7 to 7.4 kilograms (6 to 16.5 pounds), with the exception of one case. In this one, death occurred from cardiac paralysis on the seventy-eighth day and there was no loss in weight up to the sixty-first day but rather marked oedema of the face and legs.

In none of the cases was the complete picture of beriberi obtained, except in those in which white polished rice formed the staple article of diet, but in one case fed upon red rice the diagnosis of beriberi was almost definite. Indeed, we believe that, had this case been encountered otherwise than in the course of this experiment, the diagnosis of beriberi would have been fully justified.

The occurrence of marked symptoms of beriberi in case No. 1 and early symptoms of the disease in No. 3, both fed upon white rice together with the alcoholic extract of rice polishings, requires some comment. The members of this group were given daily 40 cubic centimeters of the (unheated) alcoholic extract mixed with the rice after it was cooked; that is, they were given the amount of extract obtained from 320 grams of rice polishings or from the polishings obtained from approximately 3.2 kilograms of red rice. Even this amount, however, did not prevent some of the symptoms of beriberi from developing in two of the cases of this group. The result of the experiment, with this group, therefore, suggests that, whatever may be the results obtained with this extract in preventing polyneuritis in fowls and in curing this condition after it has developed, for the prevention of beriberi in adult man or the usual treatment of the disease,⁷⁸ some other substances, such, for example, as the mongo bean, *Phaseolus radiatus* Linn. (*katjang idjo*), or yeast are evidently far superior and much easier and cheaper to obtain.

However, Chamberlain and Vedder⁷⁹ have shown that it is possible to cure infants suffering with beriberi by means of this extract, and where the age of the child is such as to preclude the addition of the necessary nutritious articles to the diet or

⁷⁸ However, for the treatment of certain fulminating cases of beriberi the use of the protective substance in a more concentrated form, if it can be obtained, would appear desirable.

⁷⁹ *Bull. Manila Med. Soc.* (1912), 4, 26.

where milk is unobtainable, it would appear from their experiments that its use was advantageous.

Recently Tsuzuki⁸⁰ has claimed for a substance, which he calls *antiberiberin* and which consists of a concentrated alcoholic and ethereal extract of rice-bran, marked therapeutic properties for the cure of human beriberi. However, the strength of the extract employed and the details of the experiments are not given. Nevertheless, our experiment with Group I shows that some substance present in the rice polishings evidently has an effect in preventing the development of beriberi in adult men since 4 of the 6 subjects of the group developed no symptoms of the disease. It, however, also shows that the substance which seems necessary to prevent the symptoms from appearing is not contained in any large amount in this extract.

Our opinion in this respect in regard to the alcoholic extract, formed from the results of our experiments, is in accord with that of Cooper and Funk,⁸¹ who state that "polishings appear to contain only a very small amount of the active substance," and of Funk⁸² who believes "the substance is only present in small amounts, probably not more than 0.1 gram per kilogram of rice." Schaumann⁸³ claims that only 0.5 gram of the active substance which plays only a mediating part in the metabolism is present in the rice-bran and Simpson⁸⁴ states that extracts prepared by complicated methods can prolong the life of the animals, but do not restore them fully to health. In his experiments birds gained twice as much in weight in three days' treatment with yeast as in three weeks' treatment with large doses of the extract which Chamberlain and Vedder employed in their experiments.

Evidently, symptoms of beriberi may also sometimes occur in individuals (see Case No. 13) in which red rice forms the staple article of diet, when the diet is a very monotonous one comprising but few articles and is continued for long periods of time, and the appetite of the subject partaking of it becomes poor and he loses continually in weight.⁸⁵ The influence of work

⁸⁰ *Beihefte z. Arch. f. Schiffs- u. Trop.-Hyg.* (1912), 16, 495.

⁸¹ *Lancet* (1911), 2, 1266.

⁸² *Journ. Physiol.* (1911), 43, 1400.

⁸³ *Arch. f. Schiffs- u. Trop.-Hyg.* (1912), 16, 357.

⁸⁴ *Trans. Soc. Trop. Med. & Hyg.* (1911), 5, 87.

⁸⁵ Obviously the food comprising our diets was not subjected to steaming or to prolonged high temperature in cooking as is frequently the case with tinned articles of food.

and exercise may also be a factor in such instances in preserving the appetite. None of the subjects in our experiments did any work or practically took any exercise. However, the diet in which red rice formed the staple article was obviously the most favorable one. The diet which consisted largely of extract of rice polishings mixed with the white rice was the next most favorable, while that one in which white rice formed the staple article of diet was the least favorable of all. It is evident from our experiments that beriberi may be produced by the prolonged consumption of a diet in which white rice constitutes the staple article of diet. Of the 17 individuals fed upon such a diet, 8 developed beriberi, and the stage of the disease was well advanced before the close of the experiment. All of these cases had distinct loss of the knee jerk, in addition to other well-marked symptoms of the disease. Symptoms of the disease appeared in some cases in from sixty-one to seventy-five days from the commencement of the diet, and the diagnosis was definite and the knee jerks gone in one case as early as the sixty-third day of the diet. In another case the knee jerks disappeared by the one hundred fifth day of diet.

In Fraser and Stanton's experiments no case of beriberi occurred in less than eighty-seven days, and the majority of the cases occurred at a considerably later period, in from one hundred twenty to one hundred sixty days. However, the individuals in their experiments were engaged in hard labor in the open country. From their experiments and our own it would appear that the incubation period of beriberi is not less than sixty days. Undoubtedly, the incubation period varies with the character of the diet. None of the individuals in our experiments developed symptoms suggesting scurvy.

CONCLUSIONS.

It is evident that among the individuals comprising our experiments beriberi was produced only by means of the diet, and that the disease has, therefore, a true dietetic causation. It is further evident from our experiments that beriberi develops owing to the absence of some substance or substances in the diet necessary for the normal physiological processes of the body. Without the supply of such substances in the food, beriberi results. Such a substance or such substances are evidently present in red rice and in rice polishings and also in small amount in the alcoholic extract of rice polishings, and when these articles are added to what would appear to be an otherwise phys-

iologically proper diet, they usually prevent the development of the symptoms of the disease. In some instances, however, even when these substances are constituents of the diet, when the diet is without variation and composed of very few articles, and the individual suffers from loss of appetite and the assimilative functions appear to be poor and he loses markedly in weight, symptoms of beriberi may develop in such individuals. However, such symptoms may be dispersed by causing a variation in the diet by the addition of other nutritious substances to it. It is also evident from our experiments that the disease is certainly not an infectious one in the sense which we usually employ this term. The rigid isolation of the prisoners undergoing the test would seem to exclude the possibility of the introduction of an infectious agent through any other individual or by the introduction of any article. And although the individuals of Groups -I, II, and III all mingled freely together, there was no tendency of the disease to spread in Groups I and III. It is also noteworthy that the cases of beriberi developed under the most favorable hygienic conditions with exception in regard to diet. It is not probable that the infection could have been introduced with the food, since this was all freshly cooked, and at a temperature at which only a spore-bearing organism would survive. The food was also eaten a very short time after being cooked. Moreover, if the infection had been introduced with the food, the incidence of the disease should have been the same in all of the groups, which it was not. No fermentation of the rice employed occurred either before or after it was cooked, so that it would appear that the action of such bacteria as have been described by Kohlbrügge ⁸⁶ and by Bréaudat ⁸⁷ could be excluded. It has been suggested that a diet of white rice predisposes to the disease, since it furnishes a better medium for the development of the specific organism which resides in the intestine of the host, and that the red rice or extract of polishings forms a preventive for the development of such a specific organism. There is no definite evidence of such an hypothesis and, moreover, the results obtained in our experiment would argue against it, since in two instances, at least (Nos. 1 and 13), distinct symptoms of beriberi were present in individuals who had received these substances in the diet. It can not be claimed with reason that the resistance of the individuals having been lowered by weakness and loss of weight, the specific organism residing in the intestine of the individual was able to

⁸⁶ *Loc. cit.*⁸⁷ *Loc. cit.*

increase and multiply and produce the disease; for in several instances where the loss of weight of the individuals was marked and their general condition poor, as was manifested by the occurrence of erosions about the corners of the mouth, sore mouth and tongue, and conjunctivitis, no symptoms of beriberi developed. Indeed, from our experiments there is no evidence of any nature which suggests that beriberi is an infectious disease, and on the contrary the evidence is definite that beriberi in the Philippine Islands is due to the prolonged consumption of a diet which lacks certain substances necessary for the normal physiological needs of the human body. That the disease encountered was true beriberi was confirmed definitely by the lesions encountered in the pathological study. As to the definite chemical nature of the substance or substances in the food whose presence prevents the development of beriberi further investigations are necessary, but from a practical standpoint as we are cognizant of the etiology of the disease, its cure and prevention is a simple problem. For the prevention and cure of beriberi in man all that is necessary is that he shall be supplied with a liberal and nutritious diet suitable to the physiological needs of the body. The recent researches of Schaumann,⁸⁸ of Chamberlain, Vedder, and Williams,⁸⁹ of Funk,⁹⁰ of Axelholst,⁹¹ and of Simpson⁹² have thrown much light upon the question of the nature of the protective substance in the diet. Nevertheless, the opinions are not yet in accord in regard to its exact chemical nature which still appears to be unknown.

Fraser and Stanton⁹³ have repeatedly called attention to the fact that the phosphorus content of the rice serves as an indication of the extent to which the rice has been polished and have suggested that any rice which contains 0.4 per cent or more of phosphorus pentoxide might be regarded as safe for a staple article of diet in preventing polyneuritis gallinarum in fowls and, hence, beriberi in man. They state—"None of the rices connected with outbreaks of beriberi yielded more than 0.26 per cent of phosphorus pentoxide. The rices substituted for these and which were effective in preventing the continuance of

⁸⁸ *Arch. f. Schiffs- u. Trop.-Hyg.* (1912), 16, 28. This article also gives the references to this author's earlier publications on this subject.

⁸⁹ *This Journal, Sec. B* (1912), 7, 39. This article also gives the references to the earlier publications of these authors.

⁹⁰ *Journ. Physiol.* (1911), 43, 395.

⁹¹ *Trans. Soc. Trop. Med. & Hyg.* (1911), 5, 76.

⁹² *Ibid.*, 87.

⁹³ *Loc. cit.* and also *Lancet* (1911), 2, 1159.

the outbreaks yielded not less than 0.4 per cent of that substance." More recently Heiser⁹⁴ advocates for the prevention of beriberi the passage of a law placing a tax upon rice which contains less than 0.4 per cent of phosphorus pentoxide, such rice being regarded legally as polished rice, and no tax on rice which contains 0.4 per cent or more of phosphorus pentoxide, such rice being regarded legally as an unpolished rice. Although it seems quite definite that a rice containing this amount of phosphorus will prevent the appearance of polyneuritis in fowls, nevertheless, from our experiments it is evident that beriberi in man may be produced by rice containing 0.37 per cent of phosphorus pentoxide when it forms the staple article of a little varied diet. Therefore the question arises as to whether the margin of safety is sufficient between such a rice and that containing only 0.4 per cent of this substance. Since it has been generally admitted that the higher the phosphorus content of rice the less is the liability of that rice to produce beriberi and since Fraser and Stanton found as an average result of all their examinations that unpolished rice contained 0.54 per cent of phosphorus pentoxide and Aron⁹⁵ found that unpolished rice in the Philippine Islands contains 0.557 per cent of phosphorus pentoxide and freshly husked rice 0.455 per cent, before legislation is enacted it would seem to be advisable to consider carefully the question of the amount of phosphorus pentoxide which a rice should legally be required to contain in order for it to be regarded as an unpolished rice and to be exempt from taxation in the Philippine Islands.

⁹⁴ *Journ. Trop. Med. & Hyg.* (1912), 15, 124.

⁹⁵ *This Journal, Sec. B* (1910), 5, 81, 98.



ILLUSTRATIONS.

PLATE I. Plan of Bilibid Prison.

II. Bartolina and cell house. (Photograph by Cortes.)

III. Interior of cell house. (Photograph by Cortes.)

IV. Transverse section of sciatic nerve. (Photograph by Martin.)

V. Longitudinal section of vagus nerve. (Photograph by Martin.)

VI. Transverse section of sciatic nerve; same specimen as shown in Plate IV. (Camera lucida drawing by Castro.)

VII. Longitudinal section of vagus nerve; same specimen as shown in Plate V. (Camera lucida drawing by Castro.)

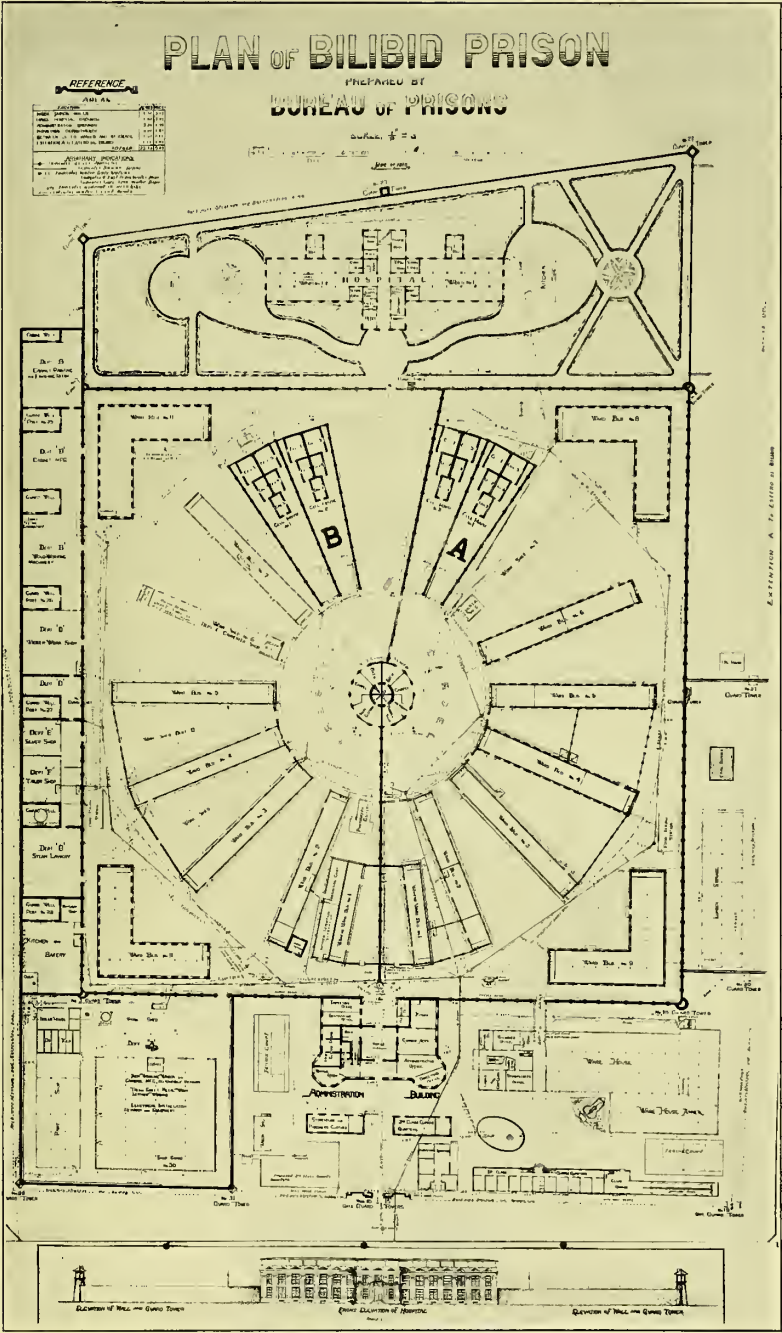


PLATE I. PLAN OF BILIBID PRISON.

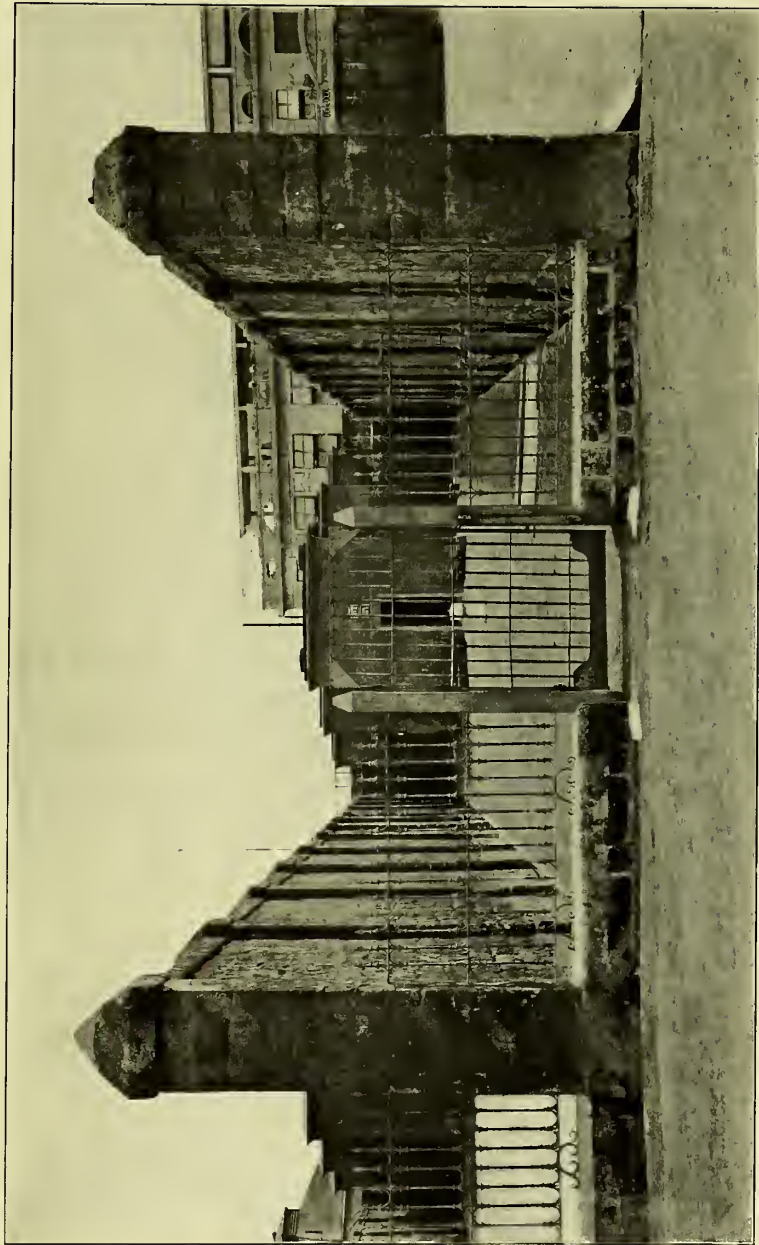


PLATE II. BARTOLINA AND CELL HOUSE.

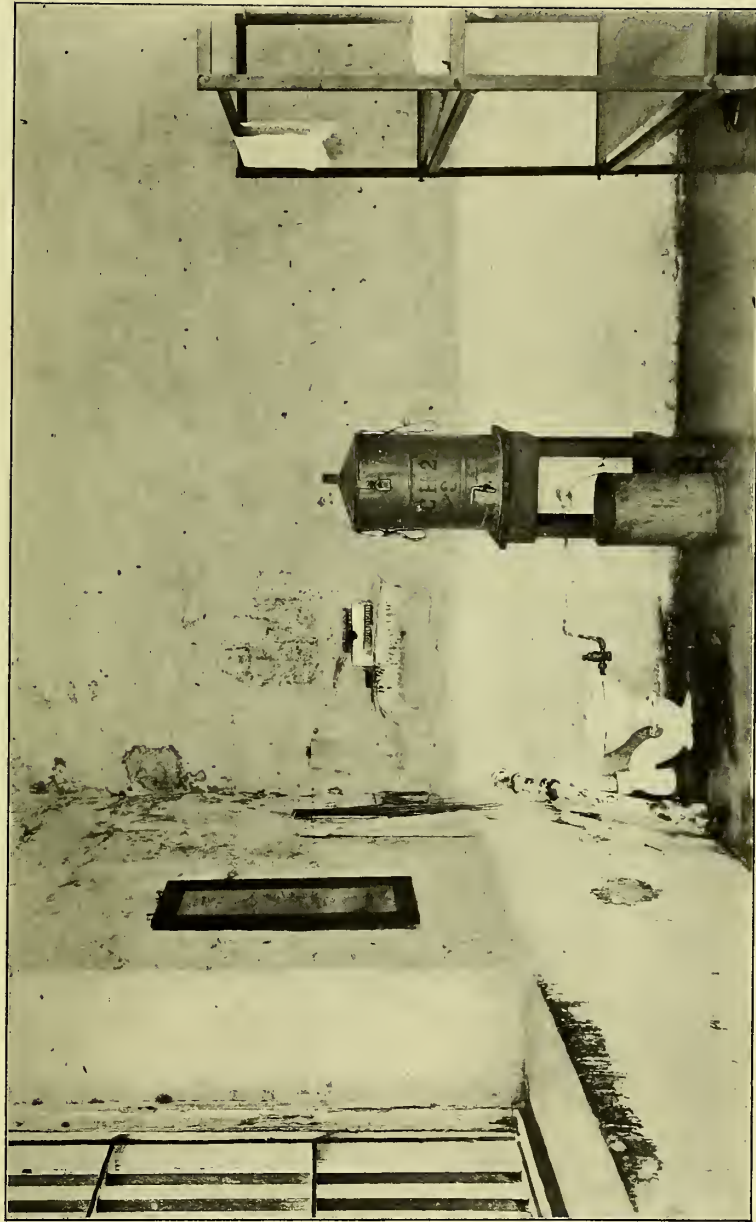


PLATE III. INTERIOR OF CELL HOUSE.

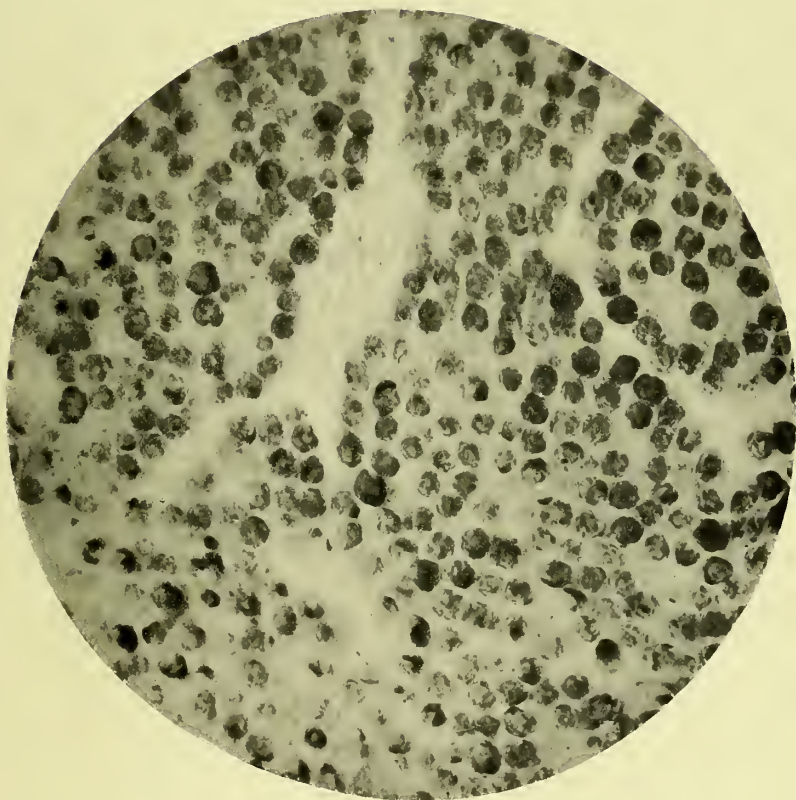


PLATE IV. TRANSVERSE SECTION OF SCIATIC NERVE.

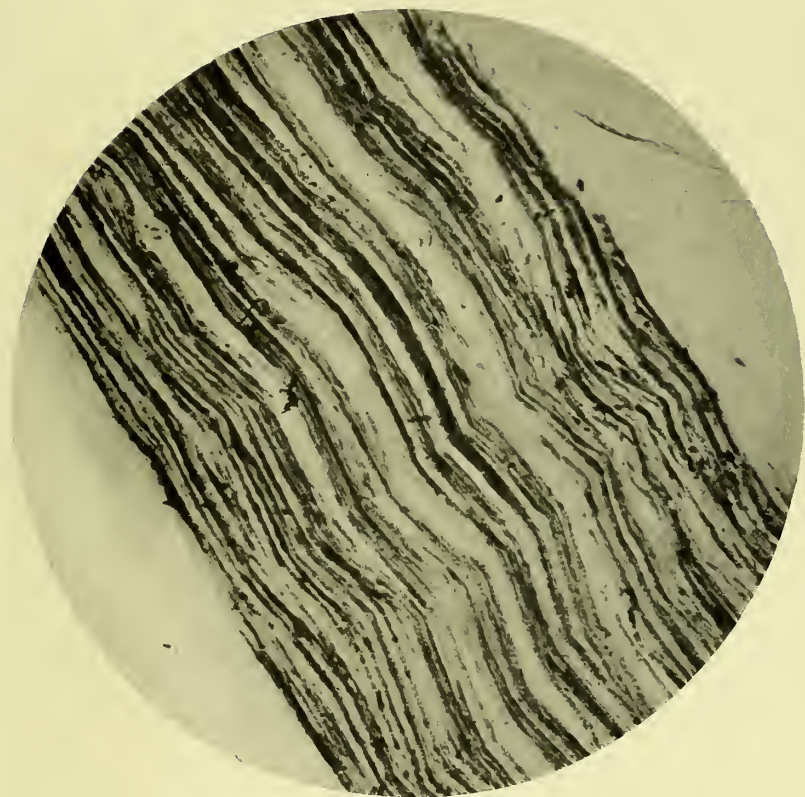


PLATE V. LONGITUDINAL SECTION OF VAGUS NERVE.

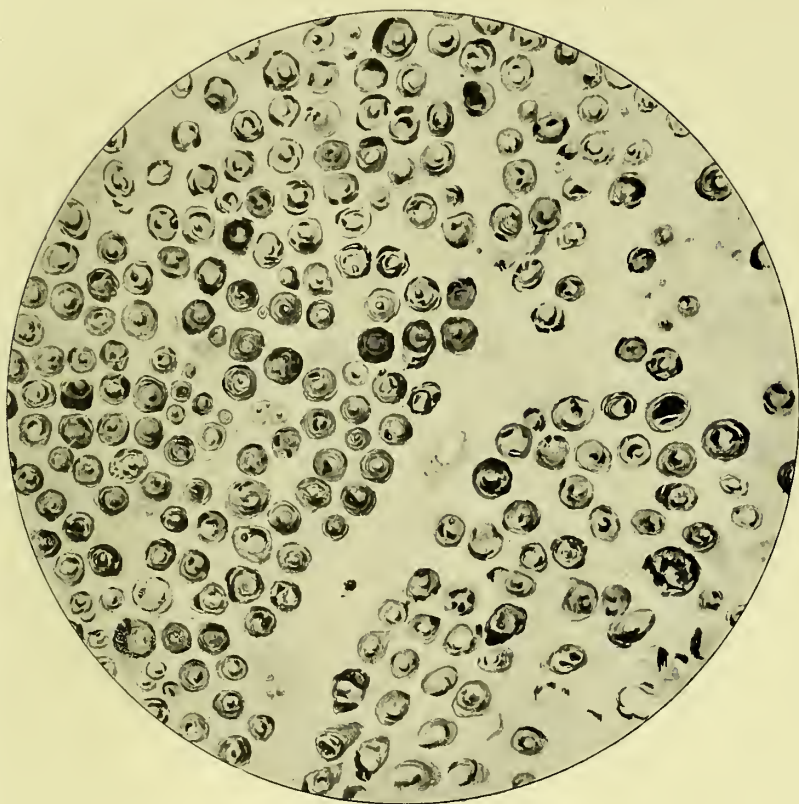


PLATE VI. TRANSVERSE SECTION OF SCIATIC NERVE.



PLATE VII. LONGITUDINAL SECTION OF VAGUS NERVE.

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